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ABSTRACT

Among various possible pedagogical approaches which favor the integration of an environmental dimension into educational processes, gaming and simulation seem particularly suitable to environmental education. Environmental games and simulations reproduce in a simplified and didactical manner the complex nature of concrete environmental problems. The game situation can take into account various factors as well as the values, interests, and behavioral patterns of different social actions (e.g., scientists, government officials, or the general public) which are likely to contribute to the generation and solution of environmental problems. Games and simulation provide the student-players with a framework which helps them to appraise situations in a multidisciplinary perspective, reveals the importance of balancing group values and interests in the solution of environmental problems, and prepares them for efficient decision making. This guide on the design of simulation and gaming aims at providing basic practical knowledge for the purpose of stimulating specialists in charge of curricula and materials development, as well as teachers, to adapt existing games and simulations to their particular situations or to develop original materials of a similar kind. The guide comprises two parts. The first develops fundamentals of gaming and simulation design; the second provides examples of games, including a specific game devised for generating other games. (CW)

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Guide on simulation and gaming for environmental education

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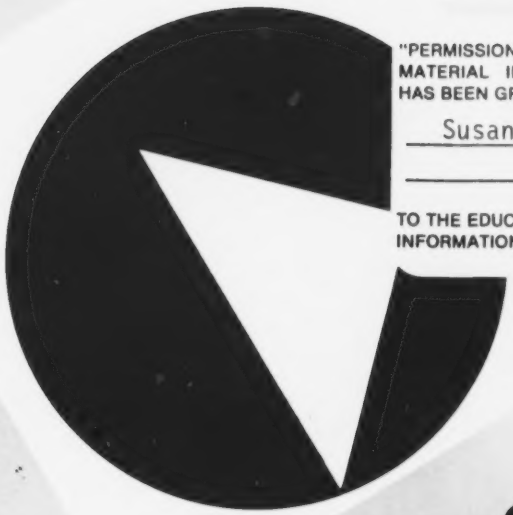

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by John TAYLOR

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Guide on simulation and gaming for environmental education

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It goes without saying that simulation development, like other educational innovations, relies on the continual dedication of enthusiastic practitioners and their willingness to share insights and ideas with others. In this corporate development process the author owes a great debt to many. In particular, special thanks must be extended to the designers of the simulations and their publishers, who readily agreed to place their material at the disposal of UNESCO. Rex Walford of Cambridge University not only played a central part here but has allowed the text to draw heavily on our earlier joint work commissioned by Penguin Books and the Open University Press.

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Finally, it must be acknowledged that simulation — and writing about simulation — can be a time-concuming business. In this respect much is owed to resilience of the family and the forbearance of long-suffering friends. Here the load has fallen on my wife who, throughout this project, has acted as unpaid research assistnat and tolerant secretary.

To all the above and to many others who have freely contributed in some way, the writer would wish to renew his thanks and sincere appreciation.

Preface

The various international and regional meetings on environmental education organized by Unesco since 1975, with the co-operation of the United Nations Environment Programme (UNEP), have stressed the importance of developing appropriate content and methods for the incorporation of an environmental dimension into various levels and types of education. In this perspective, special emphasis was placed on content and methods which stimulate development of interdisciplinary teaching-learning approaches oriented towards the solution of concrete environmental problems.

In the light of these considerations, the Unesco-UNEP Interactional Environmental Education Programme (IEEP) has undertaken the preparation of a series of publications dealing with strategies for the integration of an environmental dimension into school and out-of-school educational processes. Among various possible pedagogical approaches which favour integration, gaming and simulation seem particularly suitable to environmental education. Environmental games and simulation reproduce in a simplified and didactical manner the complex nature of concrete environmental problems. The game situation can take into account various factors — natural, social, cultural, etc. — as well as the values, interests and behavioural patterns of different social actors -- economic agents, scientists, government officials, the general public, etc. — which are likely to contribute to the generation and solution of environmental problems. Games and simulation provide the student-player with a framework which helps him to appraise situations in a multidisciplinary perspective, reveals the importance of balancing group values and interests in the solution of environmental problems and prepares him for efficient decision-making.

The guide on the design of simulation and gaming, therefore, aims at providing basic practical knowledge for the purpose of stimulating specialists in charge of curricula and materials development, as well as teachers, to adapt existing games and simulations to their particular situations or to develop original

materials of a similar kind. It is hoped that the preparation of this methodological guide will be a particularly effective means of coping with the scarcity of such educational material in most countries.

The guide comprises two parts. The first develops fundamentals of gaming and simulation design; the second provides examples of games, including a specific game devised for generating other games, with a view to facilitating the comprehension and practice of the proposed guidelines.

The guide on the design of simulation and gaming for environmental education was prepared by Dr. John Taylor, Dean of Environmental Studies and Assistant Director of the Northeast London Polytechnic. The opinions expressed are those of the author and do not necessarily express the views of Unesco.

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Introduction

Scene: A conventional classroom, blackboard, wall displays, high ceiling and institutional lighting. For once the chairs are not in serried rows facing the front but are arranged in groups where teams of students seem unaffected by the teacher who appears to be casually observing proceedings. From time to time certain exclamations are audible to everyone:

What are the advantages of putting the motorway so close to the village – are there no alternatives?

We don't pay rates to be steam-rollered into accepting everything the planners in the Ministry of Transport want to thrust upon us!

It's time we were aware of wider possibilities other than parochial issues on our own doorstep!

It's all very well for you, but I have a business to run and a future to safeguard – the motorway is bound to mean loss of trade for me.

What is going on is a simple role-playing game called Spring Green Motorway. Various interest groups are preparing for a town meeting to discuss the impact of the building of a motorway close to their village. The game produced by Community Service Volunteers is related to a fictitious English setting. However, similar scenes are replicated elsewhere throughout the world, whether it be students in Ecuador playing simple agricultural and marketing games or pupils in Malaysia using gaming procedures to heighten their understanding of village planning and residential layouts.

In all these examples, the teacher has found a way of involving the students in complex issues concerning their environment. The conventional approach would be the lecture method. However, here the teachers have given the pupils the chance to experience for themselves the excitement, intricacy and challenge of acquiring and using knowledge about their surroundings. In other words, these teachers have made a conscious decision to concern themselves with active student involvement in the learning process rather than accepting a traditional and more passive teaching mode.

This text takes the view that there is nothing especially difficult or even novel about using simulations. Indeed, some form of simulation may be familiar to anyone who has seen young children running a 'play-shop' in or out of school. Role playing is basic to much of the learning that takes place in drama studies. However, the application of simulation techniques within environmental education programmes does break new ground and to date little specific guidance has been available to those who wish to explore this territory.

This guide then, seeks to remedy this discrepancy and is concerned with innovative approaches to environmental education which rely on a related set of simulation techniques. It is already clear that these techniques have proved useful to a number of teachers and that they might have an even wider role in improving learning opportunities throughout the world.

In the view of the Intergovernmental Conference on Environmental Education (Tbilisi, USSR, 1977), *environmental education is* taken to consider the environment in its totality — natural and man-made, ecolgical, political, economic, technological, social, legislative, cultural and aesthetic. The *simulation* approach to this subject area can be thought of as teaching-learning methodology which involves the players taking an active part in decision-naking, influencing the form and nature of their environment.

Widespread concern for both environmental education and simulation is a comparatively recent phenomenon. Both areas have existed for a number of years in their own right, but have only recently emerged as a more popular and better defined focus of attention. As far as is known, the guide examines both topics *together* for the first time. It seeks to broaden the general awareness of role-playing and gaming-simulation; it endeavours to highlight the appropriateness of selected approaches; it provides step-by-step guidance; and it presents a range of examples of tried and tested material, with a view to helping fix the reader's ideas about the design of simulation exercises.

It must be stressed that this guide is seen as *an introduction* to an extensive and rapidly developing field. In essence, it is best viewed as basic appetizer to the delights of simulation – addressed exclusively to the needs of environmental education. If the publication serves as a stimulus to greater experimentation and development in environmental education in schools, it will have achieved a worthwhile purpose.

PART ONE

An introduction to the elements of environmental gaming and simulation

I Growing environmental consciousness

Environmental consciousness can be viewed as very much a child of the sixties in terms of its widespread recognition. Scholars such as R. Carson (1962), B. Commoner (1971) and P. R. Ehrlich (1969) warned of the detrimental influence on our environment of exponential population growth and rapid technological development. These and others warned that our very survival rested on achieving a sensitive balance between the considerable and mounting forces affecting the world's environment.

The alarm was focused on dangerous levels of pollution in water, air, earth and living things; major disturbances to the ecological balance; depletion of irreplaceable resources; and a tragic neglect of the man-made environment. It was argued that economic development without proper regard for the environment would seriously affect the ability to sustain continued growth. One of the most able proponents of this view was the 'Club of Rome' in their report *The Limits to Growth* (Meadows et all, 1972).

Recognition of the Issues

It has to be acknowledged that a series of well-publicized disasters had in turn prompted a growing awareness of the potential consequences of greater environmental catastrophes. Landmarks like the Torrey Canyon, the Amaco Cadiz, Seveso, the Gulf of Mexico and Three Mile Island incident, all in their turn have had a significant impact. There followed a growing public awareness that our environmental resources need more careful husbanding and stewardship. Neglect of these skills, it was increasingly realized, can have dramatic implications.

Growing concern about the management of the environment in turn motivated people to become more interested in their *influence* over their own living conditions. Increasingly it has been argued that development and environment need to be juxtaposed in harmony rather than conflict. What is required is

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more rational and imaginative management. A pre-requisite to more sensitive attitudes is, of course, increased understanding.

Responding to the challenge identified by pioneer writers and threats of world-wide disasters, the mass media have stimulated considerable concern for an increased public awareness of environmental issues. The need for environmental education was recognized by the international agencies at the United Nations Conference on the Human Environment (Stockholm, June 1972). A more specific concern for environmental education was endorsed by the Tbilisi Conference. The Tbilisi Conference constituted the starting point of a new phase of interest where environmental education was seen as vital to all members of society.

The Tbilisi Conference saw environmental education as a lifelong process needing to be provided at all levels, both in and out of school. It should foster in the public at large – children, adolescents and adults alike – an awareness and better understanding of environmental issues; it should provide members of certain occupational groups directly concerned, be they architects, engineers, town planners or whatever, with a full grounding in environmental matters; and, finally the conference resolved that there should be an international effort to train research workers and other professionals likely to specialize in environmental science. In sum, education was seen as having an essential role in preventing and solving environmental problems.

The concept of environmental quality

During the later sixties and early seventies, it slowly became accepted that the quality of the environment was being degraded. Closely associated with this apprehension was a growing concern for the quality of human life – in terms of physiological and psychological aspects of health, welfare and economic survival. Acknowledging this world-wide general concern, the Stockholm Conference identified four major areas of need as guidelines for international action in maintaining and improving the quality of life. These involved:

1. The improvement of human settlements and health;
2. The development and use of water, land and energy resources;
3. Harmonizing development goals and social and cultural values with environmental quality objectives;
4. The protection of living resources, the ocean, and climatic conditions.

On the basis of these broad goals, more detailed recommendations for international action were specified. In part, these recommendations saw environmental conservation as a major component in maintaining and improving the

quality of life. They also recognized that the whole world had to accept personal and collective responsibilities for environmental control and management.

A significant achievement of the Stockholm Conference was the international commitment to world-wide environmental co-operation. It was realized that it was vital to get beyond pious and popular statements of intent. Individual or isolated efforts aimed at solving many of today's problems of environmental degradation were likely to have little impact. Co-operative action was required and the general view was that this collaboration had to be underpinned by a common understanding. A call for environment education was the result and the Tbilisi Conference played an important step in defining what might be involved by identifying the aims and characteristics of environmental education.

The nature of environmental education

A new ethic was being sought through environmental education. From the individual to the whole international community – whatever their age, geographical position, cultural background or intellectual group – a new awareness of the complex and dynamic interrelationship between man and his total environment had to be recognized. One of the primary aims of environmental education, endorsed by the Tbilisi Conference, was to enable people to understand the complex nature of environmental issues arising out of biological, cultural, economic physical and social interaction. The individual and the community had to be provided with the means of interpreting the interdependence of these various elements in space and time so as to promote a better use of resources. A key concept relates to the view that fostering responsible and effective participation concerning the quality of the natural, social and cultural environment is basic to improvement. To that end, education's role should involve dissemination of information on development methods likely to maintain and enhance a harmonious relationship with the environment. In short, all environmental education has to contribute to the advancement of knowledge and the acquisition of attitudes and skills required for the preservation and improvement of the quality of the environment.

As far as values are concerned, environmental education has to emphasize development options. The choice between options should rest on rational analysis, synthesis, evaluation and action. It is widely believed that skills for devising better solutions can best be developed through involvement in these activities.

The final report of the Tbilisi Conference argued that 'Environmental education is an integral part of the education process. It should be centred on

practical problems and be of an interdisciplinary character. It should aim at building up a sense of values, contribute to public well-being and concern itself with the survival of the human species. Its force should reside mainly in the initiative of the learners and their involvement in action and it should be guided by immediate and future subjects of concern'.

To sum up, therefore, it may be said that environmental education is an all-embracing concern for everyone. It is centred on the building of attitudes and codes of behaviour compatible with achieving high environmental quality. Most importantly, it is directed towards improving the existence of *all* living things. Although some of its roots are well established, it is essentially a new and highly dynamic field. Consequently definitions should be viewed as rough approximations likely to evolve and be refined – perhaps rapidly, as the subject itself develops.

Contemporary environmental education characteristics

The proceedings of the Tbilisi Conference have isolated certain design and structural features of environmental education which relate to:

(a) Problem solving approaches
(b) Interdisciplinary working
(c) Wider educational integration
(d) Dynamic lifelong learning.

In essence, acknowledgment of these features means that environmental education must be directed to the solution of the practical problems of the environment. It demands an interdisciplinary approach to establish a new structural relationship between knowledge, expertise and behaviour. Education has to underpin community action which must be future-orientated and a world-wide responsibility. Thus the search is under way for learning opportunities which exploit the social role of educational institutions and forge more productive relationships between lifelong 'students' at all levels.

Why a simulation approach?

One vehicle for achieving these new environmental aims, perspectives and structural relationships consists of simulation activites. Instructional simulation systems, whether they be simple role plays or elegant gaming simulations, are relatively modern developments – creatures of their times – and very much orientated towards evolving contemporary needs.

A good deal of common ground is shared by environmental education and simulation activities. They are both seemingly absorbing concerns for young and old alike. Both are widely perceived to be relevant to present and future needs and both provide unrivalled opportunities for direct involvement at a variety of levels.

Contemporary environmental education, like today's simulations, places considerable emphasis on:

(a) Adventurous exploration and enjoyable involvement
(b) Extensive interdisciplinary participation
(c) Decision-making anchored to complex practical problems – and living with the consequences of decision-making!
(d) Future relevancy unfettered by conventional wisdom
(e) Improving performance, through applying knowledge, considering values, perceptions and decision options and responding to feedback.
(f) Setting verbalization and social skills alongside numeracy and literacy

Of course, educational areas and methods do not exist in isolation. They are both part of open-ended complex systems. However, for the purposes of this handbook, both sets of issues are to some extent isolated from the wider system in order to focus on new ways of thinking and acting with respect to a new subject area. This book cannot claim to present any magic formula for introducing and using environmental education. It concentrates on learning situations where creativity and co-operation tend to predominate – and where the learning process values assessment of the implications and effects of alternative actions *before* and *after* decision-making activity.

The present work endeavours to convey the spirit of exploration. It tries to present a readily comprehensible assessment of selected aspects of a rapidly evolving field and an innovative technique. At best, it will be used as a basic primer, operational handbook and ready reference work. Above all else, it seeks to present an instructional anthology representative of the range and current potential value of simulation activities throughout environmental education.

II Simulation, gaming and related activities

There is a tendency to use simulation terminology rather loosely and there is unfortunately a variety of interpretations to be found in the literature. Shubik (1975) has helpfully seen a simulation as:

'involving the representation of a system or organism' by another system or organism that purport to have a relevant behavioural similarity to the original system. The simulator is usually simpler than the system being simulated and is more amenable to analysis and manipulation.'

It is most useful to start by appreciating that it is possible to conceive of at least four clear and distinct varieties of simulation, namely the case study, the role-play, the gaming-simulation and the machine simulation.

Each form of simulation tends to incorporate differing levels of abstraction and it is possible to think of increasingly elaborate levels of abstraction as you move from case studies through role-playing and gaming-simulation to machine simulation (See Figure I).

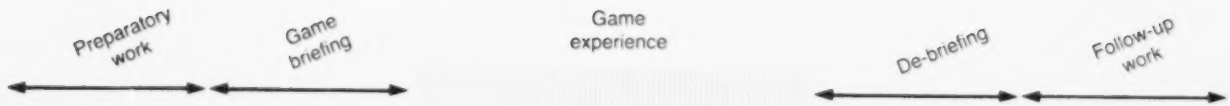
Thus it is easy to view all simulation as activities which evolve around selected parts of the real or a hypothetical world. To a greater or lesser extent they take from the real or hypothetical world what the designers or participants deem appropriate. They can all be thought of as abstractions. Case Studies are generally less abstract and machine simulations are often more abstract. Whatever their degree of abstraction they are simplified representations which can be animated to aid our understanding.

To improve the reader's perception of what is really at stake here, it is proposed to make certain distinctions clear by describing each of these varieties of simulation in turn.

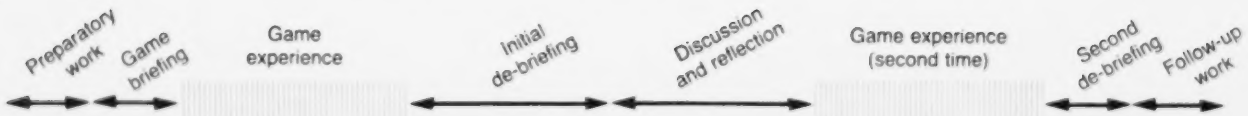
(a) Case studies

The case study is a technique for presenting a situation through selected 'historical' papers. A descriptive account is built up, using differing combinations

Figure II Game Experience Positions
Source: Taylor and Walford (1978)



1. Game used as centrepiece of a unit of work



2. Game used twice to allow players to reflect and improve their performance

3. Game used as an initial stimulus

of real world data, narratives, tapes or films. Although not commonly thought of as a simulation, the case study relies on a highly selective use of a representative sample of materials drawn from a range of sources. Key elements are selected and the background noise and trivia is excluded. As with all forms of simulation, considerable discrimination is required to determine what is presented or omitted but a core feature of the case study concerns the extent to which it is anchored to reality by using a large amount of real world material.

Hence an environmental case study can cover any 'condensed' history of activities, such as isolated mineral working developments and their impact *or* how a settlement has grown in response to certain pressures over a prescribed period (see for example Taylor's (1977) *Development Control Case Studies* or Sutcliffe and Smith's (1974) *History of Birmingham* 1939–1970).

(b) **Role-play**

This involves not just the examination and discussion of documentation as with 'case studies', but requires participants to act out and improvise roles and situations using a given data base as a point of departure. The participants have to act out a sequence of events. They have to move from 'outsiders' to 'insiders', moulding the data and shaping actions and events as a spontaneous performance.

Role-play can often be a relatively simple and straightforward activity since it does not have to rely on a wealth of data and formal structure. All that is required is for the participant to accept a new identity, step inside someone else's shoes, and act and react as appropriately as he is able. What may happen in role-play is anyone's guess; there are few formal restraints on the situation, even if the group involved may be aware of some general objectives.

The essential core of the activity in role-play is understanding the situation of another person. Participants are placed in a position in which they are given the opportunity to 'feel' what it is like to be 'on the spot'. They are confronted with what is at stake for the individual as well as for the group. Through direct involvement, it is hoped that they gain a greater understanding of other roles and relationships, as well as a better awareness of what they themselves are doing.

Thus, those taking the role of inhabitants of Spring Green, described more fully later in the present work (p. 78 et seg.), are required to step inside the shoes of villagers faced with the prospect of a new motorway on their doorstep. Living standards are under threat and a range of 'gains' and 'losses' have to be contemplated in the 'so-called' interests of progress.

In summary, role-play may be seen as an activity which is generally more

open-ended than other forms of simulation. It is concerned with individual enactments and group interaction for deriving insights, achieving empathy and developing skills rather than for solving problems. It can cover more fanciful situations and is open to very dramatic involvement. The emphasis tends to be on free-exchange and free-wheeling activities.

(c) Gaming-simulation

If we continue looking at varieties of simulation along the spectrum of increasing abstraction, then *gaming* or *gaming-simulation* is a half-way house between the case study and role-playing, on the one hand, and machine simulation on the other. It is generally seen as being less complex and less abstract then computer simulation although in certain instances a computer may be required to look after the accounting or to model certain critical relationships. It is, however, more complex than role-play because it relies on more formalized procedures and a greater structuring of relationships.

For example, at a specific level the Hertfordshire Conservation Game, described elsewhere by Taylor and Walford (1978), concerns the siting of a third London Airport. It is an environmental conflict simulation which focuses on proposed landing grounds and the detailed ramifications which can be associated with intensive airport site development.

The game was devised for senior school pupils and requires a teacher to act as chairman. Based on a map covering most of south-east England, there are ten major roles involving at least fifteen players. The roles are divided into two groups – the 'construction engineers' and the 'conservationists' – in such a way that the game demands a constant interplay between them. In addition, problems can be generated within groups when a seemingly ideal landing ground can involve prohibitive infrastructure connection costs *or* when the farming interests do not coincide with naturalists' preservation desires. Costings related to alternative sites are required and conservation points are recorded. Thus preferred locations for the siting of the airport can be seen in relation to lowest construction costs and in turn set against a conservation loss. Several games can be played simultaneously and alternative solutions can be evaluated.

At a slightly higher level of abstraction is the CLUG Model — the Community Land Use Game designed by Allan Feldt (1972). This game provides an analogue of the interactions involved in land economics and land development which can be related to differing situations. It is a 'board' type of game, with specific and fairly rigid rules, which might be compared to a combination of chess and monopoly. The rules of the game are representative

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of some of the economic forces which tend to shape urban growth. By reducing the multiplicity of variables affecting urban land to a small number of important factors, each move of the game is related to major aspects of the development cycle. Teams of developers have fixed amounts of capital to invest and they may use this to further personal and/or community interests as far as they are able and the environmental context allows. With prudent management, teams can maximize their investments and also make a positive contribution to the growth of the community. Thus, each run of the game is a 'town-building' exercise where success can be gauged, amongst other things, in terms of team assets or by the size and nature of urban expansion.

Finally, at a very high level of abstraction there are gaming-simulations such as Starpower, designed by Garry Shirts (1970). This simulation presents a model of a social system which is divided into three groups. The participants compete to earn points through the trading of chips of differing values. What is not known by the participants at the beginning of the game is that one of the groups has been pre-selected to receive chips of greater points value than the other two groups. In this way, players soon begin to discover that they are involved in a social system of the 'haves' and the 'have-nots'. The 'haves' will usually begin to exert their power to their own advantage. Meanwhile the 'have-nots' tend to suffer various degrees of anxiety, frustration and ill-will arising out of their disadvantaged situation. In short, this is a game which generates instant reflection on environments in the actual world which are analogous to those of the simulation. Pupils in schools often equate it with the class-room situation where the so called 'bright' students are continually rewarded and the 'slow' learners are perpetually ignored *or* derided. At a wider level, the game can be seen as a reflection of society with racial or socio-economic groups in the poverty trap and suffering continual hardship and discrimination. Consequently one of the great virtues of the model is adaptability in depicting a range of social systems right through to the international dilemma posed by 'rich' and 'poor' nations.

Learning games which fall into the gaming-simulation category may vary widely in their details, but many appear to share the following core features:

1. They are principally used for learning how systems react under continually changing conditions.
2. They are often simple abstractions of relatively complex aspects of hypothetical or real world situations.
3. They achieve their simplicity very largely through reducing complex

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operations to a series of simply expressed actions controlled by explicit rules.

4. They expose participants to certain pre-selected features under relatively controlled and risk-free circumstances.
5. They allow the concerted use of physical models, mathematical representations and human operators.
6. They require participants to assume roles involving various degrees of co-operation, competition and conflict between players or teams, and to make decisions which reflect their understanding of key features of the model.
7. They produce certain decision 'pay-offs' – rewards or deprivations – determined by chance, by reference to human assessments, or by the use of predetermined rules and formulae.
8. They provide varied experience in controlling the course of events over time where the state of the simulated environment is continously altered in response to the quality of accumulated decision-making.
9. They generally compress 'time' and, as a result, are able to provide rapid feedback on the results and the consequence of decisions.
10. They progress in predetermined stages or periods and each period represents an allotted 'time' span.

Gaming-simulation seeks to represent the essence of a situation. Whether the particular game model has an obvious structure or not, inter-relationships between a number of factors can be displayed, visibly manipulated and continously adjusted. Gaming simulation involves players in various degrees of competition and co-operation where their actions are in part governed by methods of procedure and various rule systems. Most games are primarily concerned with a desire to understand a decision-making process involving both quantitative and qualitative elements.

(d) **Machine or computer simulation**

This branch of simulation activity is rooted in mathematics. Probability theory, game theory and other associated mathematical techniques are utilized to build in chance and random elements to simulated activities and these are processed by electronic calculator or computer.

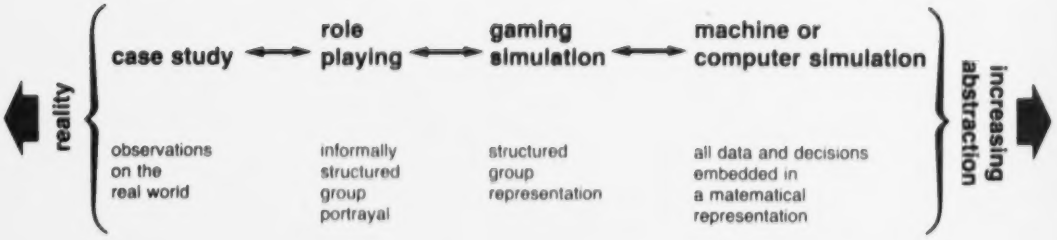
More usually, computer simulation is intended to provide answers rather than to understand processes. With data, chance factors and constraints programmed into a machine, human participation is limited to an initial development of the programme and a response to the result which is produced.

These four strands of development – case study, role-play, gaming and machine simulation have been described to provide some general background. The central concern will be with role-playing and gaming-simulation but it is essential to appreciate some of the broader relationships. It is equally important to appreciate that the varieties of simulation discussed above are in few ways clear-cut and definitions in this field are a matter of considerable dispute.

There can obviously be overlap between varieties of simulation. For example, case studies can be used for role-play by participants being presented with a real problem and selected real world data and then being asked 'What would you do next?'. Similarly, a gaming simulation can be designed to contain role-playing activities within the framework of 'the game', or a computer or calculator can be used merely as an adjunct to a game, to speed up the time-scale and to save participants unnecessary work which they could well do themselves, if only they had the time and inclination.

Finally, it needs to be said that definitions are, of course, never completely satisfactory descriptions. What actually happens in the classroom or in any other operating session elsewhere need not always fall within the guidelines presented above. Much of what has been said has relied on simple ordering devices free from jargon. In a book of this kind, the range of related nomenclature and the wider esoteric aspects of the simulation semantic debate can be justifiably avoided.

Figure I A Spectrum of Simulation Techniques



III An introduction to role-playing

From the outset it is important to see role-playing as providing the student with a dramatic confrontation and classification of:

(a) information and personal expectations about society
(*look at yourselves*)
(b) inter-personal relations and life styles
(*look at actions and behaviour of others*)
(c) relationships of data and knowledge of day-to-day situations
(*look at the world in general and social life in particular*)

In simple terms, role-playing calls for the assumption of a new role outside the normal every day accustomed role. This other role may be that of a real person, or may be fictitious. In either case, the role may or may not be completely specified and heavily circumscribed. Thus the student acts a part to stimulate learning and to create better understanding.

In the Spring Green Motorway role-play example, described later, most of the players have to put themselves into the shoes of villagers. Their initial position is described and from then on it is left to the teacher in charge to decide how much 'free rein' to allow. In other words, the group can develop their own approach, ideas and initiatives in relation to the threat of a motorway on their doorstep and the teacher is left to determine to what extent the evolving situation needs to be structured or directed — if at all!

Just as Shakespeare has done, it is possible to consider that 'all the world's a stage and all the men and women merely players': they act out a role not only in terms of a patterned way of evaluation and behaviour to others and their environments but also in relation to how they perceive themselves and their own setting. It is a medium which encourages individual spontaneity without the risks of sanctions and reprisals. In providing opportunities for active involvement in problem situations, it makes the necessary connection between knowing a principle and acting upon that knowledge.

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Role-playing formats

The technique of role-playing can be used in many ways to look at:

ideas
feelings
expectations
attitudes
behaviour

At the same time, the technique seeks to raise the amount and level of verbalization within groups. In examining such issues, a role-playing situation can be introduced by:

(a) **The direct involvement approach**

Here participants are invited to 'act-out' an instant run-through of reactions to material just placed before them. Such an approach relies heavily on spontaneity and a general willingness to indulge in 'free-rein' activities stemming from the fact of being placed on the spot.

(b) **A total briefing approach**

This style of role-playing can encompass everything from preliminary warm-up sessions, technique explanations, briefings, film and video introductions, background reading, role-induction, etc. prior to direct inter-personal involvement. Thus the actual acting out or dramatization is seen as but one incident in the total learning sequence. Throughout this type of approach a considered commitment must be balanced against the more impromptu stance obtained through minimum briefing associated with the immediate involvement approach.

Consequently, role-plays such as the Spring Green model can be seen as part of a much larger package. In this case, the briefing can cover the nature and changing character of village life, the implications of motorway development; wider contextual material can be fully explored, for example, in relation to the impact of communications technology on the life styles and standards of living.

(c) **Role-reversal/re-run approach**

Whatever briefing is adopted, the option is always available for participants to switch roles or positions in the role-play. This mechanism is a means

of exploiting the technique to the full. Not only are participants put into someone else's shoes but after this experience they are forced to see the world anew by being placed into yet another person's position in the same setting.

Role reversal sessions offer an opportunity to appreciate more than one or two points of view. Greater understanding and mutual consideration is generally fostered and higher levels of empathy frequently obtained. For example, as an extension of Taylor's (1977) development control case study work, Booth (1981) has produced video tapes which can usefully be seen as a starting point for further work. In this context, role-playing exercises can be based on the video tapes. Students can re-enact the whole or parts of a public inquiry into a development issue of the Spring Green Motorway type. Alternatively, using the videotape as a point of reference for relating to certain statutory procedures, students may build or run through their own selected examples.

Whatever type of approach is used, it should be stressed that differing formats can provide extremely useful bases of comparison to highlight a wide range of perspectives and insights.

Role-playing can serve a number of purposes

1. **Diagnosis/evaluation:**

   To find out how individuals react in certain situations e.g.

   Does he or she identify readily with other people's roles and problems?

   When are certain individuals automatically aggressive/passive/withdrawn?

2. **Decision-making:**

   By working, or role-playing, through a number of options, participants can see a range of outcomes being generated. Although optimum solutions are not identified, it is possible to increase the general appreciation of the consequences of different actions e.g.

   What happens if a collaborative or competitive approach is adopted in central area renewal?

3. **Rehearsal:**

   By practising responses to certain situations, it is hoped to improve an

individual's verbal adequacy and inter-personal skill. In essence the concern here is focused on preparedness e.g.

Can you cope with being a newcomer in a strange environment?

How would you respond when a television interviewer identifies your company as a major source of atmospheric pollution?

4. **Attitudinal change:**

By acting out or dramatizing a situation, new perspectives can be significantly highlighted.

The background to differences can be revealed and role-reversals can provide a radical basis for reassessing misunderstandings and disagreements e.g.

What would happen if, instead of being the planning officer trying to refuse planning permission, you were the applicant appealing for the right to build?

5. **Self-awareness:**

Through direct involvement with certain action sequences, the individual is confronted with a wider awareness of how others see him. A range of perceptions is thrust upon him which in turn serves to increase or improve his self-awareness. Strengths and shortcomings at individual and group level can be identified and examined in an uninhibiting manner e.g.

Why is it that three people on a council sub-committee cannot agree on priorities?

What has caused the 'tenants association' to split into two factions?

Clearly there are many differing types and levels of role-playing activity. For example, it can be used to portray historical events and examine individual and group conflicting situations, or it can provide a framework for the development of social skills. In effect the role-playing dramatization provides both students and teacher with a laboratory situation for analysing and practising many differing aspects of interpersonal relations.

Although this book provides a range of simulation examples, it cannot claim to cover the whole spectrum of uses or contexts. Like any other educational technique, role-playing has to be used as a component in a larger instructional plan. For reasons of space, contextual relationships have not been explored fully but it needs to be stressed that simulations should not be used as isolated events.

The unique character of role-playing lies in its reliance upon the participants activating the learning situation and seeing its wider relevance. Differing styles and amounts of creativity can be exploited to demonstrate how the gap between *thinking* and *doing* can be narrowed and related to real world needs. It cannot be denied that role-playing is a provocative technique which has the potential to stimulate interest in many aspects of environmental education.

Conducting a role-playing exercise

Clearly there are few standard ways to conduct a role-playing exercise. However, once the objectives are determined, the logistics known and the role-play selected, then certain major steps are usually encountered.

1. **Explanation of role-playing as an activity**

   As some students may not have encountered role-playing before, some technique introductions might be necessary. 'Ice-breaker' or 'warm-up' games can be advantageous in such settings as a means of putting people at ease and relaxing the group as an entity.

2. **Briefing sessions**

   In covering the objectives of, and the context for, the exercise, it is important to be both clear and direct. Any ambiguity or verbosity can alienate the participants prior to direct involvement. It must always be recalled that additional information can be injected into the exercise as and when the need arises. Often participants can call for further elucidation or more data once a level of confidence or a certain mastery is achieved.

3. **Role allocation**

   To avoid any accusations of teacher domination, favouritism or manipulation, a random allocation of roles is often advantageous. It must be clearly seen to be fair and role-reversal re-runs offer the opportunity for wider participation and more balanced involvement. Thus both the initial allocation and the re-run allocation of roles can be seen as public events handled by the participants.

   Usually there are two kinds of roles involved in any allocation process – individual roles or group roles. These distinctions have to be made clear

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and the role profiles have to be adequate to generate natural responses. Power and responsibility should rest with the participants and the greater their freedom then the greater the motivational and learning benefit.

4. Operating session

Starting times, terminal points and deadlines have to be set and adhered to as closely as possible. Having made this clear then a great deal rests with the participants. Role players can and should be allowed to be aggressive, awkward or flippant as they deem appropriate. Group norms quickly provide a balance and generally inhibit the more bizarre forms of behaviour. The importance of the group dynamic cannot be over-stressed. The unusual and unconventional does not have to be sanctioned and the open-endedness rarely needs to be circumscribed.

5. De-briefing

Feedback discussion sessions are an essential part of the role-playing learning process. Where an historical situation has been replayed, the discrepancy between the operating session and reality provide an excellent point of departure.

It is important to bring role players back to reality and to disassociate the actors clearly from the role they played. This is an important step because it then allows the participants to concentrate on the role behaviour rather than the characteristics of an individual's performance.

Different participants can take the chair and all the role players should be encouraged to present their individual point of view – What did they perceive to be the major issue or how did they go about resolving differences?

After these views are aired and discussed, then interest can turn to the collective behaviour and outcomes.

How did the groups organize themselves to explore options and to achieve certain objectives?

How effective were they in achieving certain goals?

Should the role-play be re-enacted and if so with what changes?

Finally, the closing discussion can be even more open-ended in asking:

What lessons were gained from the experience?

Would individuals act differently if placed in a similar situation in the future?

The advantage of formal de-briefing questionnaires should not be

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overlooked. For designers and teachers, constructive comments on the mechanics and fine tuning of the exercise can stem from more reflective consideration given when responding in writing as well as verbally to de-briefing questions.

6. Evaluation

Over and above the assessments of the experience which can be undertaken in the de-briefing session, it is important to recognize that the teacher has a distinct personal evaluation role. Initial goals and objectives have to be related to *verbal*, *behavioural* and *written* evidence. From this analysis various indications will emerge with respect to what might have been gained from the experience.

It must be noted that the finest actors are not necessarily the most competent students and interest rests on the ability to *understand*, *feel* and *play an assigned role*. An index of performance can thus be established in relation to social maturity and skill development.

The role-playing experience can be used as a pointer for further work, whether by role-playing or by other techniques. Any evaluation procedure can isolate gaps to be filled, points to be reinforced and new areas of concern. It may well be that further instructional goals can be elaborated and new learning directions established.

Finally, when looking at all the stages involved in running a role-playing exercise, it must be remembered that the great virtue of the technique are its ease of use and the open opportunity it offers everyone to be freely and dramatically involved. Ideally, role-playing should be non-authoritarian in both organization and practice.

Ultimately it should not be forgotten that the value of the technique rests on the student's ability to apply examples and lessons of role play to his own interpersonal experience.

IV The demystification of gaming procedures

It can be argued that one of the better ways of getting to know a game is not only to play the game but to run through steps in the design process. Certainly an appreciation of the design factors underpinning simulation activities immeasurably increases the sensitivity and flexibility with which the technique may be used. For this reason it is worthwhile to consider both the simulation design process as well as the actual operating arrangements. It will be clear that any such description has to be a generalized overview which must concentrate on key underlying principles.

Elements of the design process

Simulation games may fall into many categories in terms of context, form, style and level but there are several elements commonly covered by designers irrespective of their philosophy or methodological stance. These major design steps generally include:

(1) Defining the problem
(2) Describing the intent of the game
(3) Setting the scenario
(4) Defining the roles
(5) Specifying the game rules
(6) Drawing up an accounting system
(7) Building a prototype
(8) Running development trials
(9) Finalizing the documentation and equipment.

Very few systematic accounts of game design stress the step-by-step linear approach. As one might expect, many designers see their final model as a consequence of pursuing many iterative loops as well as creative leaps. However, the key items specified above are explicit and commonly encountered landmarks well worthy of further elaboration.

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1. Defining the Problem

Systematic course planning calls for precise statements of what a student should be able to do as a result of completing an assignment or course. Normally, educational objectives specify what students should be able to do at the end of an activity that they perhaps could not do (at least not as well) at the beginning. Great emphasis is placed, quite rightly, on changes of behaviour which can be derived from educational experiences. This behavioural emphasis distinguishes objectives from goals or aims. Broad brush statements are goals or aims whilst objectives are more precise statements of what a student should be able to do or achieve.

The most common and one of the simplest ways of grouping objectives is in terms of *attitudes, knowledge* and *skills*. Once certain objectives are specified, for example, in terms of:

(a) what is to be done;
(b) under what conditions; and
(c) to what level of competence or performance standards,

then the selection of an appropriate approach, teaching method and evaluation procedure becomes clearer. At this stage there is no commitment to a simulation approach; rather, the teacher is seeking to sort out his or her ideas with a view to establishing a clearer sense of direction.

Writing objectives and moving from them to course activities, grouping objectives and determining appropriate learning situations involves considerable rigor.

Apart from effort, most writers see the process as involving keen professional judgement, inspired guesswork and not a little luck.

2. Describing the intent of a game

Taylor and Walford (1978) have pointed out that it is acknowledged that round pegs do not fit into square holes – however perfectly the round peg is made. Likewise some simulations do not fit certain educational situations, not because of their inadequacies, but because they were never designed for use in that situation. Consequently, having reviewed educational goals and objectives, the teacher must then have some idea of what he wants to achieve and how. For example, if the teacher wants students to have a competent mastery of a large number of factual pieces of knowledge, he may not wish to use a simulation in which the design emphasis is on the revelation of basic ideas and general principles.

Here it is as well to remember that, broadly speaking, most instructional simulations involving gaming procedures set out to produce their desired effects by:

(a) presenting a simplified abstraction of the bare essentials of a situation free from trivia and irrelevance;
(b) concentrating on making explicit essential relationships and the fundamental interplay between key roles;
(c) unfolding time at a very much quicker rate than normal so that the implications of action in a dynamic situation can be clearly and repeatedly felt;
(d) allowing students to 'sit in the hot seat' and feel the direct impact of the consequences of decision-making;
(e) offering opportunities for collaborative learning on self-directed lines (i.e. learning as much from one's mistakes, and from the mistakes of others, as from one's successes).

These attributes tend to cover the major type of intention in the mind of simulation designers, but they do not, of course, preclude other objectives – e.g. the learning of factual material – which may well come through participation in the simulation itself.

As the identification of some of the intentions of simulation material is not always clear, it is necessary for potential users to undertake trial runs. Ultimately there is no adequate substitute for taking part in the simulation oneself. In reviewing simulation materials or when taking part, it is as well to return to the designer's probable pre-occupation and to try to step into his shoes in answering such questions as:

Why is a game being designed here?
What other games cover this or related areas?
What system is the central concern?
Who are the potential users and what is likely to be their initial level of competence?
Where and when will the game be used?
How much time is available?
What resources are available in terms of instructors, participants, space and materials?

By drawing up such a specification it is possible for the potential user or adapter of a game to have a tangible overview of what is at stake. For the designer it represents a concrete point of departure which can be

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seen as a set of questions to return to throughout the design process. Ultimately such a specification serves, at the conclusion of development work and field trials, as the basis for evaluation of the total effort.

3. Setting the Scenario

The 'scenario' of a gaming-simulation is a brief and partial description of the system or process being modelled. Something has to be left out so that players can concentrate on selected central features. This process of abstraction must be guided by the specification questions just described. The tendency is always to be tempted to put in too much detail.

It has to be recalled that even at this preliminary modelling stage, a delicate sense of balance must be maintained between ideals and operational practicalities. At every stage in the design process 'trade-offs' have to be considered and hence constructing a scenario, like building a game model, is in itself a learning process.

Even when a satisfactory model is not achieved, a considerable insight into the nature of the phenomena under study is achieved by those involved. Sometimes the model-building process itself is one means of demonstrating to the teacher how little he may know about his own teaching objectives, the value of each academic task, its associated response and its relationship within the general educational framework. It is as well to be reminded constantly that the design process calls for clear thinking in relation to the precise formulation of objectives, and continuous reappraisal of concepts, assumptions and values concerning all aspects of learning.

If design work is carried out by the teacher and pupils together, students can be asked to be explicit about their own conception of the way that 'models' work within the real world. Corporate design of this kind implies that designers already have some initial (though perhaps crude) model ideas and that these can be classified and improved by animating their model in public. This public scrutiny and debate helps to sharpen perceptions and concentrate attention on real-world and model system disparities.

This scenario sets the scene; it is a preliminary model which provides the actors or players with a setting. It can provide background data on the context and is likely to specify the time and place of the action. In other words the starting point for the action is the initial scenario. Circumstances existing at the outset of play can be defined by such items as case histories, newspaper reports, photographs, maps, charts and

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display boards. It has to be remembered that the total scenario may not be revealed to all. In other words, some players may have information covering selected facets which may be withheld from others at the outset. However, at this stage it is best to visualize the scenario as a picture of starting conditions for the game.

4. Defining the roles

Role descriptions may have been included as part of the scenario but it is useful to consider them as a separate entity. Again, another set of questions is likely to emerge:

> Which characters are central to the action?
> What decisions have to be made and by whom?
> Who supplies the data upon which decisions are made?
> Who can exert controls on decision-making?
> What roles might have to be invented to provide additional control mechanisms?
> What categories of people or types of behaviour such as voting systems might have to be represented by a person?

Once again we have to be reminded that the central concern is with significant major characters. Our interest rests not only with their prominence but the extent to which they *intervene* in the progress of events. In order to design a playable game, roles have to be created which maximize the quality and frequency of interaction. Similarly, roles have to be built up as mechanisms for drawing out players – forcing them to expose their actions and inter-relationships as a means of promoting discussion and in turn speeding learning.

No role profile should ever be complete. It pays to offer players the chance of adding to their individual richness. This flexibility leaves room for inventiveness and enterprise and should allow every game run to get away from the conventional wisdom. Each role profile must encourage involvement and exploit opportunities to intervene in an evolving and highly dynamic situation.

5. Specifying the game rules

Much of the momentum associated with gaming activities results from the sensitive definition and application of rules. The game dynamic consists of a cycle of events which in turn are broken down into a series

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of steps of play. These steps cover the explicit progression of major activities in the game. They provide the basic guidelines which signal prescribed actions. Players move through the game guided by a set of instructions which foster learning and knowledge of the problem situation being represented. In short, the game rules make the simulation work.

The preliminary identification of participants and objectives is a foundation for activities but the actual process of developing interactions such as set 'rounds in the game' are the very keystone of the simulation itself. These interactions may proceed by the choice of participants and a discovery of their actions resulting from some card held by the controller; it may develop through the sequential throw of dice or the reading of random number tables; or, alternatively, it may be a continuous process in which rounds as such are not defined, although the working time of the simulation is seen as an analogy to the passing of real time e.g. one hour in the classroom may represent one day in the life of a government.

But whatever kind of interaction is prescribed, it must fundamentally represent an analogy to the process that the simulation seeks to highlight; consequently, in many simulations it is problem-solving activity which represents the way in which the simulation moves onwards.

Once this interaction is formulated in some satisfactory and manageable classroom terms, a major part of the work is done. What then follows is the need to formulate sequences of 'How to Play' and rule constraints which determine the outer edges of the model. Some of these rules can be built into the model framework.

For instance, in the Spring Green Motorway simulation concerning the building of a road from one place to another, the designer does not allow any other form of transportation to be considered. This is not a rule designet to simulate reality so much as an artificial constraint designed either to maintain focus on the central intention of the simulation or to improve the simple logistics of running the game. Other constraints in the same simulation – say, concerning what official consultation procedures are allowed by government or the role of town meetings in the public participation process might best be seen as constraints founded in the reality of the situation itself.

Needless to say, during the design process the draft rules and their occurrence are likely to be re-evaluated, re-adjusted and sometimes completely redesigned several times. However, it is worth repeating that a sense of balance must be maintained between rule systems which reflect the real world and artificial elements demanded by the limited

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resources available. Clearly, most simulation designers prefer to have a heavy balance in favour of the former rule, so that the framework of the game can be seen to mirror reality whatever the state of the game. Consequently, in Rex Walford's Caribbean Fisherman game, described below, pages 107 et seg., constraints of any sort are very largely avoided. Yet once the players have got the idea of the game, they are encouraged to introduce extra rules to bring the game closer to reality.

6. Drawing up the accounting system

The paramount function of any game accounting system is to supply feedback on the adequacy of performance. Players can learn the consequences of their actions from simple pencil and paper calculations or from complex programmes run on a computer. However, as learning is heightened by improving the clear relationship between action and response, then direct and explicit accounting procedures can be a big help.

For example, when a player decides on a course of action, then, if he can refer to a simple 'look up/ready reference' table, he has instant feedback on the outcome of his choice. The table, in other words, provides pre-ordained consequences if a certain course of action is selected. This device is seen at its best in the Caribbean Fisherman game where the player has a straightforward table to indicate the value of his catch inshore or offshore, according to the weather conditions as indicated below:

WEATHER	VALUE OF CATCH FROM EACH INSHORE POT	VALUE OF CATCH FROM EACH OFFSHORE POT
Good day	2	6
Bad day	4	0

Arriving at such a clear statement may not be a simple matter. It has to be noted that game designers are not only proving the basis for an ongoing monitoring system but are seeking to create a sequence of meaningful learning experiences. The interest and drama has to be maintained and the accounting should *reinforce* and *heighten* the general sense of purpose. In other words, the accounts must *not* be seen as a chore but as a vital means of gauging achievement.

In appreciating the sensitive relationships which exist between *the*

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scenario, *the roles* and *the accounting system* it is as well to pose such questions as:

What should be tabulated and how?
What form of feedback should be available and to whom?
What data should be privileged to certain roles?
When should feedback be provided and how regularly?
Is there a need for overall monitoring and comprehensive displays?

Whatever indicators or reporting systems are used, it is desirable to give all players a hand in maintaining individual records of their progress. Obviously this gives them a better understanding of their position in relation to the problem being considered and, in addition, takes some of the load off the central accounting function. However, it is a combination of individual and central accounting via record forms, playing boards and wall charts which tends to offer overall clarity. Games, like life, rely on multifaceted appraisal systems and a combination of vidual aids should seek to summarize a spectrum of game decisions and consequences. The ultimate question with respect to such records tends to be: is the information clearly useful and relevant?

7. Building a prototype

Game construction is an iterative process. It involves moving from relatively simple conceptualizations to well-rounded playable procedures. Considerable trial and error commitments are required. It is likely that walking through the steps specified above will have started to circumscribe the shape of possible 'mock-ups'. Such early formulizations may borrow heavily from other sources so that a good deal of effort can rest on resolving the overall fit of a variety of elements.

The constant warning from designers is not to attempt too much. Concentration on essentials is vital at early stages in the construction process. Once complexity is introduced, then the use of well-designed equipment becomes important. Game equipment must be as functional as possible and must purposely underline the main elements in the game model *and* the learning process. Vivid symbolism can heighten dramatic effects and aid the colourful portrayal of complex and highly dynamic situations. The whole experience has to be memorable if it is to be easily discussed and usefully recalled.

At the heart of the prototype building process is a set of choices that

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the builder or designer must have in mind at almost every stage in the design process. The choices are listed below and they can be seen as an axis along which a simulation can be placed, depending upon its purpose:

(a) Richness of detail *v.* manipulative simplicity
(b) Complexity *v.* playability
(c) Heavily structured learning *v.* free play involvement
(d) Manual immediacy *v.* computer accuracy
(e) High order goals *v.* specific objectives
(f) Closed system *v.* open system.

In short, the prototype construction stage is not without challenges. It does involve considerable rigour as well as fortitude and several options may have to be discarded. Again it is useful to remember that it is far easier to add comonents to a robust prototype than it is to introduce extensive elaborations to an already over-loaded complex framework. Simplicity at this stage does leave the door open to fine tuning and the elaboration of refinements.

8. Running development trials

'Development runs' are intended to highlight likely operational problems prior to full-blooded exposure to the critical eye of the classroom. It is important to note, however, that the success of the simulation needs to be seen not merely in terms of its successful operation, but ultimately in terms of its relationship to the real world it seeks to represent. However enjoyable or intriguing the model, it is of little use if it has shifted away from the external realities from which it was originally built.

There is an insidious temptation to build in rules because they seem to equalize the chances of participants, or because they create nicely dramatic situations; this may well serve the purposes of those who build games for commercial entertainment, but it does little to win friends for simulation in an educational context. Whatever the result, it is essential to acknowledge that we are concerned with a partial picture which endeavours to communicate essentials. It should always be accepted that classroom simulations are incomplete dramatizations which offer a bridge between theory and practice.

Trial runs are bound to encounter something which is incomplete. Malfunctioning components have to be recognized and the relationship between theory and practice has to be further underlined. Usable models

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emerge from a great deal of creative effort, hard work and not a little luck. By persevering with constructive trial runs, the game model can be tuned into a playable form. It is as well to remember that this is an exhausting process which is very demanding in terms of time and goodwill. Few games are considered as ideal models and game designers rarely consider their work completely 'finished'.

9. Finalizing the documentation and equipment

This account has stressed perseverance and, equally, the final stage in the design process calls for continued application of this quality. Writing clear and straightforward playing instructions takes time. Operational manuals, role profiles and decision forms set the tone of the game. They convey the spirit of the play and they help to make explicit the learning objectives. Designers are quick to point out that although a certain amount of guidance is required prior to playing a game, participants can pick up many of the fundamentals by actually acting out a role rather than reading about it. The essence of the approach is 'learning by doing' and few people appreciate being overburdened with documentation.

The designer, however, has to provide material to brief the teacher and would-be game administrator. An operator's manual is likely to give the background to the game, a statement of intent, descr iptions of roles, the scenario, steps of play, the accounting system, the number of participants required, the logistical and material needs, and a full description of any special equipment. All this information must be clearly presented and readily referenced.

The players, on the other hand, need a simpler overview. This overview should convey the spirit of the game and should isolate the major objective. The learning process can be stated briefly but should not be laboured. Player instructions must invite involvement. Participants should be stimulated to accept the challenge and immerse themselves in a game rather than a handbook.

Designers have to put themselves into the shoes of someone coming fresh to the game and any briefing has to leave the newcomer wanting to know more and anxious to claim a share of the action!

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V Using simulation games for educational purposes

With a wider appreciation of what is involved in designing a game behind us, it is now possible to turn a more informed eye onto the task of selecting and using an appropriate game. The purpose of this section then is very much directed towards how to get the best out of simulation gaming activities. Observations will be presented not only on finding appropriate games but on introducing, supervising, discussing and evaluating simulation experiences.

1. Locating suitable games

Before commencing the actual search for a suitable environmental game it is useful to return to the review of educational aims and objectives discussed earlier. Obviously the specific situation for which you want to use a simulation game will determine what type or category of game is appropriate. There are many ways of categorizing games and the literature is embarrassingly rich in this area. For simplicity's sake, environmental simulation games will here be divided into *three* categories – *synoptic, skill and practice* and, finally, *general management* games.

This simple ordering device for neophytes has the obvious advantage that any game or game run can be used to touch on each area simultaneously.

(a) Synoptic games

These models are predominantly concerned with the presentation of overviews of systems or processes. At its simplest, games such as Caribbean Fisherman present a very basic overview of subsistance fishing in the less developed world. Games of this type cover overall interrelationships and demonstrate how dynamic systems evolve. Such models are often introductory devices and operate at a high level of generality. Games such as the Community Land Use game (Feldt, 1972) and Starpower (Shirts, 1970) examine economic, political and

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social processes within a 'mini-world' tied to prescribed societal settings. As synoptic games, they pull together data and theories that may have been previously taught separately. In this sence, such games are a comperhensive co-ordinating device concerned with totalities.

(b) Skill and practice games

It has been convincingly argued that gaming is a form of language (Duke, 1974). Various forms of communication purposes can be involved and Horn and Cleaves (1980) are helpful in this respect. For example, they have listed certain communication varieties including:

Information processing and dissemination – where participants are provide with 'hands-on' experience in ordering and passing on data e.g. the Houses Game (fully described in Part Two, pages 107–16).

Information gathering – where players have to search for data to be able to proceed with the game, e.g. Goodman's Policy Negotiations Game. Goodman and Cappard, 1979).

Information sharing – where groups have to collaborate with each other to maximize their resources and in turn achieve certain corporate gains, e.g. Poverty as outlined below, pages 129–40.

Impact analysis – where participants explore decision chains and the consequences of selected actions as a game requirement e.g. Community Land Use game (Feldt, 1972).

Policy analyses – where reactions to planning options and scenarios for the future can be evaluated e.g. Duke's (1972) Metro-Apex.

Problem definition and solution – where players isolate key decision areas and try out their skill in decision-making e.g. Economy (Bracken, 1974).

Human relations skills – where players develop their empathy toward certain roles and develop behavioural skills related to negotiating, bargaining and conciliation, e.g. Spring Green Motorway and Starpower both already mentioned. In an invironmental context, these games foster communications amongst a variety of community interests. For example, the Policy Negotiations game (Goodman and Coppard, 1979) allows key decision-makers to appreaciate other points of view and at the same time begin to understand the different rationales underpinning group priorities other than their own.

(c) General Management games

These games provide valuable experience of the pressures and techniques

which are associated with complex administrations, corporate planning and overall management. They provide experience in managing complex data situations and generally offer opportunities to confront challenging environmental management problems. Games like Metro-Apex (Duke, 1972) fall into this category; this game was designed for training air-pollution control officers with complex city-region responsibilities.

Aside from these broad divisions, it is easy to ear-mark certain games according to their *setting* or *problem context*. Games such as SPRING GREEN MOTORWAY or CARIBBEAN FISHERMAN very clearly indicate their own commitment. From here on, the would-be game user is likely to be able to identify his desired subject and territorial coverage. For example, is the prime focus ecological, economic, socio-political or an amalgam of issues involved in determining environmental quality?

Guides to simulation games such as that produced by Horn and Cleaves (1980) cover these data remarkably well. Over and above the issues already discussed, this particular source provides a wealth of information which relates to logistical constraints. Descriptive information in the Horn and Cleaves Guide goes beyond the simple listing of age levels, group sizes, playing time and equipment needed by including a series of revealing commentaries on the 'state of the art' and significant attributes of particular models in selected areas.

Some of the other sources of information on resources available are listed at the end of this handbook. At this stage it is sufficient to say there is considerable general guidance available and the bigger challenge is to step beyond reading the guides and superficially inspecting the materials.

Thus it is appropriate to return to the question of educational aims and objectives. With a growing awareness of game characteristics and simulation procedures it is possible to start to view a specific game as a core activity related to other work. A welcome sign of the times is the fact that commercially produced simulations have now taken this wider context into account (see for example The Ridpest File and Longmans Simulation Packs Nos. 1 and 2, 1975) and have included extensive material related to the topic of the activity, as well as for the simulation itself.

It is to be regretted that few people have documented their views on the position and role of games in specific contexts but Taylor and Walford's (1978) diagram is indicative of how games can be used as either a centre piece of a work unit *or* as a mechanism for offering the chance to repeatedly improve performances *or* as an initial stimulus to a much longer undertaking.

2. Briefing

In simple terms, preparing a class for a simulation exercise should be as short and direct as possible. At least three types of briefing are needed with respect to:

(a) An introduction to the background and objectives of the simulation.
(b) An explanation of simulation as an instructional mode.
(c) A description of the essential mechanics of the simulation itself.

This all sounds deceptively simple. In many ways the key is knowing when to stop as much as what to cover. The experienced simulation teacher takes care to ensure that his own enthusiasm for the activity is communicated to the class. A concise and confident beginning is paramount. 'Over-explaining' a game to flagging would-be participants is a serious error. The object of the briefing is to cover the essentials and *to get the game started!* Players will need some preliminary information in order to size up the context of the simulation and assess their own part in it. A radio or television programme can act as a useful dramatic stimulus to a preliminary brief: more usually a newspaper cutting is sufficient. It may even be the material from which the simulation was devised in the first place – though some organizers will prefer to keep this to the end of the activity, when comparisons with the real world are being made. Such material may, in certain situations, have to be adapted by the game organizer to suit the aptitudes and abilities of the players; extracts from some newspapers, for example, may not match the vocabulary of 10-year-olds of mixed abilities even though the simulation itself will interest them.

Once the background and objectives of the game have been reviewed and players have a clear understanding of the game, then the teacher can move on to an overview of how the game operates. Roles and rules can be introduced without going into lengthy explanations which would dampen the players' enthusiasm. Specific questions about rules and procedures can be handled as they arise in the actual operating session.

It is important to arouse interest and project the players into the initial stages of the activity leaving some questions unanswered. The quality of briefing is bound to affect the participants' predisposition toward the game and in turn their attitude to the learning experience. An attractive start which gets the players into the action almost before they know it is the way to launch a game.

The teacher probably needs to provide as *little* rule information as he dare. It is in this spirit that everyone should realize that *a briefing should, by definition, be brief.*

3. Operating sessions

A recurrent theme throughout this book has been that there are few standard simulation answers. Similarly, there is no one way to present or run simulation exercises. The role of the teacher depends very much on the specific situation, bearing in mind that ultimately the teacher 'picks up the tabs' – that is to say, he or she in the last resort is the final arbitrer. However, it is clear that certain central tenets can be underlined.

(a) Flexible didactic frameworks

Unfettered motivation is to be encouraged rather than restrained. Free exploration and self-discovery at both individual and group level should be maximized.

Hence, nothing in any simulation should be regarded as final or absolute. For example, rule systems should be open to challenge, and procedural points can usefully be changed through majority agreement.

A simulation on the exploration for North Sea gas is a typical case where this type of flexibility can be demanded. Rules are given which cover the development of pipelines in the sea to certain terminals. One group playing the game recently came up with a surprising strategy which required a land pipeline and the building of an alternative terminal – neither of which was mentioned in the simulation rules. The perceptive teacher in charge dealt with the situation by calculating land pipeline costs on the spot, and deferred the request for an alternative terminal for two rounds while he thought about it. In his reasoning this was an accurate simulation of what a government might well do when faced with the same challenging problem. He then authorized the alternative terminal and the group in question went on to work out a satisfactory solution to their transport problem. Stimulating questioning, contention and conflict of this sort can be rewarding experiences if properly examined and openly reviewed.

Rhythms of activity

Within the classroom situation itself there can be a rhythm of activity which mixes teaching with group activity. The teacher may use the end of a round or sequence of a simulation as a point at which to emphasize what has happened, or indicate a situation of common or central concern. In doing so, he not only integrates orthodox teaching methods with the

simulation in a creative way, but also, if need be, retains a hold on the logistics of the classroom situation.

Taken a stage further, this type of informal intervention can be used when the situation seems conducive to speeding further learning and provoking consideration of deeper insights. Discussion and analysis does not have to be entirely confined to de-briefing sessions at the end of operating sessions. Breaks in play can provide appropriate opportunities for on-the-spot mediation and analysis which need not be relegated to the formal de-briefing session. Sometimes this type of intervention does not have to involve the entire group of participants; occasionally, selected teams or individuals can be taken aside to ensure that they play a fuller part in proceedings. However flexible this interaction, the learning process relies to a very large extent on players discovering a great deal for themselves – and this motivational attractiveness has to be respected.

Role of the teacher

At this point it is worth saying a word about the role of the teacher. From the foregoing discussion it is clear that he may too easily become all things to all men. Some games require the teacher to be little more than an administrator who organizes the supply of materials. Others require him to act as the overall accountant and time-keeper. Still others require him to referee disputes or act as reporter or independant observer. In short, it is likely that he will be asked to take on many roles according to the particular simulation he has selected.

Whether the teacher takes on one role or many, e.g. administrator, referee, co-ordinator or record keeper – he has to have an equal concern for his students' performance as well as his own. At its broadest, the concern must rest with a total learning situation rather than with rather narrow teacher-taught relationships. In these terms, whilst the teacher is still very much at the centre of things, he no longer retains a dominant role. As a consequence the perceptive reader will have started to note the use of more appropriate names. In gaming parlance, he or she may be the Administrator or the Controller. A small but significant point.

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However, these unfamiliar titles bring new responsibilities and hence Chartier's (1974) guidance to the unitiated may be helpful here. Chartier's 'Ten Commandments' for teachers about to use games are useful reminders with which to end any discussion on the role of the teacher:

I Thou shalt *not* correct the minor mistakes of players.
II Thou shalt *not* offer a better strategy that a player does not perceive.
III Thou shalt *not* correct any elaboration or alteration of the rules of the game by participants.
IV Thou shalt *not* review in minute detail the purposes, rules and material of the simulation game.
V Thou shalt *not* keep perfect order. *Gaming is fun and noisy.*
VI Thou shalt *not* stymie any points that seem to be irrelevant to the discussion. They often are relevant, or at worst, only brief digressions.
VII Thou shalt *not* constrain the moderate physical movement a game may require.
VIII Thou shalt *not* answer participants' questions about the game with 'that's not in the rules'. It is impossible for the designers of a simulation game to account for all events and questions that might arise in the course of playing.
IX Thou shall admit thy *lack* of knowledge about a point of the games operation or the process under study.
X Thou shalt consider a simulation game as serious a form of education as less enjoyable forms.

Operational Characteristics

With these diverse viewpoints in mind it may be useful to conclude this section with a check-list of some of the characteristics likely to emerge in a simulation operating session:

Students may show a tendency to pursue an understanding of the basic idea in depth *before* becoming involved in the actual operation.

Students may develop pre-exercise strategies, and a readiness to modify these in the light of the simulation experience.

Students may demonstrate their sensitivity to critical relationships within the simulation and to their evolution and change over time.

Students may show a readiness and ability to make decisions while under considerable pressure.

Students may show openness with respect to intuitive judgements when more reasoned alternatives are not possible.

Students may show a tenacity in the face of disappointing results and a desire to improve their performance as a consequence.

Students may show a consciousness of the important role or roles and the power of group bargaining and decision-making.

Conversely, of course, there may be an absence of these things. Different simulations will show these characteristics to a greater or lesser degree. However, these examples are illustrative of some of the human situations which may arise during simulation activity, quite apart from the spheres of cognitive or affective learning with which the simulation is identified. Thus the social significance of these techniques in the classroom is considerable.

4. De-briefing

Much of what has already been said about de-briefing in role-playing is equally relevant here. At this stage the administrator or controller returns to the role of the teacher. The transition can however be gradual if participants themselves chair proceedings. As a high level of active involvement is central to most gaming activities, it is as well to realize that many of the participants will have a need to express how they felt about the experience. This feedback needs to be capitalized upon and focused into consciousness.

The teacher's task here is more clear-cut, and, if the need arises, more dominant. He is on hand to help the participants to review systematically what they have been doing and what they have or have not learnt, and to correlate this with the reality of the situation about which it was hoped they would learn.

It may first be necessary to draw attention to some of the events of the situation from the teacher's perspective and to discuss with the students in the class how these events came about. Such discussion provides not only a revision of the simulation in capsule form, but an alternative interpretation. The discussion may also help to clarify the motives and reasoning of different groups in following certain strategies.

From this, it is likely that the teacher will proceed to a consideration of case studies which are relevant to the simulation topic. The teacher may indicate how or why certain actions in the simulation seemed at variance with what had happened in real life situations; the discussion of such variances is usually one of the most valuable parts of the task of relating the simulation model back to the actual situation which it seeks to illuminate.

Then may come some kind of de-briefing questionnaire to capitalize on the work done and to provide a reference for the teacher in evaluating the worth of the unit of work which includes the simulation. There may also have been a similar questionnaire administered at the beginning of the unit so that a pre-test and post-test comparison may be made.

Another large body of feedback material can come from the examination of different monitoring systems – whether tape recordings, video replays or whatever. Thus, certain parts of the game experience can be played back and re-examined. Such action replays have already found a central place in sporting rather than educational analysis. This material may be examined exclusively by the teacher or by the teacher and students together, depending on time availability and the quality of the critical interaction.

Additional evidence may also come from post-simulation reports and comments made by students, whether spontaneously or in classroom or homework assignments. Generally it appears that students are very ready to make such comments honestly and without reticence.

Certain game manuals now provide de-briefing guidance. Some of this guidance, such as that to be found in Lawson's (1979) Newtown or Duke and Greenblat's (1979) Trilogy of Games is quite thorough. Although it is not wise to make too many generalizations about the de-briefing process, at least six aspects of post-game discussions can be identified and are worthy of note under the following headings:

(a) **Initial perceptions**

Participants usually have strong feelings about what was at stake. They should be encouraged to be forthright about venting their immediate reactions. Here players are expressing their instantaneous answers to the question – what was the game all about?

(b) **The model itself**

If players can readily verbalize about their initial perceptions, it is not difficult for them to identify central features of the model at the heart of the game. A grasp of this framework provides a basis for later elaboration. For example did the players observe any similarities between the game and the real world?

(c) **Progress of the operating session**

In personal terms it is often easy to start by answering the question: Who did what to whom? Players can be invited to give their interpretations of what took place. Thus, each participant can contribute to the sum of knowledge in terms of what they did and why.

(d) **The simulation results**

Questions as to why certain things happened are often best delayed until some sort of consensus emerges concerning what actually happened. Once different perceptions are reconciled, in whole or in part, it is possible for the class to examine such questions as: Why did certain players behave in a certain way? What were particular teams trying to accomplish by acting in isolation? Questions like these can reveal and relate tactics and strategy to outcomes. As discussion progresses, it should be possible to more closely interweave perceptions, motives, actions and outcomes into an overall picture of the evolution of the simulation itself.

(e) **The learning achievements**

By slowly moving through the common game experience, it is possible to built up an acceptance of a common game language whereby players are tuned into the same wavelength. This commonality allows participants to transfer learning to situations which are meaningful to them. A take-off point here would consist of answering the question: What happened in the game and how does this compare with what might happen in the real world? Participants at this stage can be prompted to be more explicit about their beliefs and operational stance. Alternative ways of viewing reality can be discussed and other courses of action can be identified with the benefit of hindsight. What has been gained from the experience should be confronted by the players fully and openly.

Ultimately the teacher has to draw the discussion back to his aims and objectives if this does not materialize spontaneously.

(f) **Feedback on the whole system**

It must be remembered that it is no bad thing to review the general reactions to the simulation experience. Irrespective of the inquest on the actual results, was the game seen to be useful, relevant or challenging? What was frustrating about this particular gaming model? What suggestions could be made to improve the model? How realistic is the game and what was most frustrating about the whole presentation?

Here it is essential that the students see themselves as a useful sounding board. Their feedback should be seen as shaping the learning process especially when concrete suggestions are put forward and when they request further opportunities to repeat the exercise – a not uncommon feature of simulation activities.

5. Assessment and evaluation

It almost goes without saying that most educational methods generate considerable contention when it comes to assessment and evaluation – and naturally simulation is no exception. Indeed many would see simulation as a particular area of controversy because of the efforts of a number of scholars to bring the debate out into the open. As a consequence, it is possible to see a shift from the informal levels of evaluation to a slightly more rigorous level of concern. Modest steps in this direction are evidenced by the work of Goodman and Coppard (1979) and Horn and Cleaves (1980). Here two recent publications have brought together evaluative comments from experts in the field. Thus it is possible to acknowledge a growing acceptance of the systematized subjective judgement of experienced observers.

This realism attempts to plug a gap concerning the absence of immediate feedback of provisional research findings and working recommendations as a basis for interim guidance for both researchers and practitioners. Such interest in forging an ongoing 'educative' relationship between all interested parties should not be misunderstood. It is not intended to undermine, in any way, the continuing efforts to improve objective measurement techniques. In other words, it is important to acknowledge that a highly developed evaluation science is not to hand and more immediate and practical appraisals have a place in our imperfect world.

With these attitudes in mind, it is possible to welcome the growing number of simulation directories which have been prepared. Such simulation directories are becoming useful 'form books' or 'best-buy' guides of distinct operational significance to potential consumers.

From this useful general baseline it is possible to turn to particular validation needs. Surprisingly very little attention has been paid to sorting out different simulation uses and then moving on to consider a range of appropriate assessment and evaluation criteria relevant to particular uses. This of course is asking for a greater degree of discrimination from all practitioners and perhaps asking for a willingness to accept a number of multi-facted appraisal systems as useful yardsticks for monitoring progress. In discussing the de-briefing session a number of suggestions have been made about obtaining feedback from verbal reports, written reports, questionnaires, video recordings, observer commentaries and attitudinal/behavioural tests. This is by no means a complete list but it is indicative of the way forward. Having said this, it seems important to recognize that the validation rigour expected of simulation workers as documented in the literature seems hardly ever to be discussed, expected or, even more rarely, achieved with respect to other educational methods.

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Assessment aims

As this work has been somewhat dismissive of the grandiose dreams of some educators with respect to evaluation, it is perhaps useful to turn to the various purposes to which any assessment data might be useful. Different groups with an interest in simulation activities have different objectives in mind. Such groups include an overlapping mix of concerns stemming from their primary role in game design, use, production, promotion or educational research and development. Each tends to bring a different mix of expectations to the evaluation process – which is no bad thing – but certain distinctions need to be made clear. For this review at least three sets of evaluation have to be noted:

(a) **Practitioner contextual research**

These evaluations are concerned with how a game works in an overall instructional context. Few, if any, simulations claim to be sufficient by themselves. However exciting and motivating the operational experience, a good deal of educational activity surrounds a simulation and the extent to which overall curriculum integration is achieved is a vital concern.

An unvaried diet of simulations is likely to lead to steadily diminishing returns – just as a non-stop programme of educational films or slide-shows blunts its own virtues. The properly balanced 'mix' of human and technical resources is difficult to determine. Certainly there is a need for more research on just how teachers actually use games – and on how they marshal their resources and in turn channel them towards identifiable objectives.

(b) **Model impact assessment**

Particular games are seen as accomplishing certain forms of learning. The extent to which different types of outcomes are achieved as a consequence of particular models is very largely unknown. Similarly, the extent to which participant types can influence certain outcomes appears seriously neglected. For example we know very little about the way the mix of systems components changes the character of proceedings and in turn the resultant game outcomes.

(c) **Procedural knowledge**

Games are composed of a variety of elements and the teacher has ultimate control of the participants' handling of these elements. Knowledge of

component inter-relationships is vital in maintaining the playability of a game. Consequently interest rests not only on how the simulation is working (what it is achieving?) but how players are behaving (how are they learning?). For example, personality differences and various degrees of co-operation and conflict can create a wide variety of outcomes, desirable or undesirable – and not all predictable. Breaking the gaming process up into discreet moves does provide numerous opportunities to steer the course of a game within more productive channels. Work on identifying these control points and indicating what the teacher should look out for as the gaming process progresses is rarely documented. In the end, each instructor has to build up his own feel for the management of a particular exercise and this hard-won learning experience seems rarely to be passed on.

A notable exception in the environmental field is Walford's (1980) reflections on the development of the Caribbean Fisherman game: here experience in playing the game is discussed in relation to the formulation of new rules and the extension of its context.

From this overview of the whole process of using simulations it will be clear that no single model offers an automatic set of pay-offs. This volume, like most introductory handbooks, has over-simplified in order to communicate the essence of an activity. Much remains unsaid, or unqualified. For the newcomer to simulation there has been a deliberate attempt to avoid overburdening the reader with excessive detail or wide-ranging generalizations.

A balance has been sought which seeks to provide practical guidance arising out of a basic understanding of the characteristics and potential of the technique. Obviously, by indulging in brevity, the subtler 'shades of grey' will have been overlooked.

However, it is hoped that simulation has been clearly demonstrated to come through a productive *initial* gestation period. The foregoing discussion should help environmental simulation consumers guard against misuse. Its power is such that we should be wary of its indiscriminate use, precisely because its elegance and impact can be so seductive. In short, care and discretion are vital if accompanied by courage and vision.

To conclude on this point it is useful to re-state Schafer's (1975) maxims for today's educators:

> The first practical step in any educational reform is to take it.
> In education, failures are more important than successes. There is nothing so dismal as a success story.

Teach on the verge of peril.

There are no more teachers. There is just a community of learners.

Do not design a philosophy of education for others. Design one for yourself. A few others may wish to share it with you.

The old approach: Teacher has information; student has empty head. Teacher's objective: to push information into student's empty head. Observations: at outset teacher is a fathead; at conclusion student is a fathead.

On the contrary a class should be an hour of a thousand discoveries. For this to happen, the teacher and the student should first discover one another.

Why is it that the only people who never matriculate from their own courses are teachers?

Always teach provisionally: only God knows for sure.

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VI The advantages and implications of a simulation approach

At this stage it is appropriate to ask what strength simulation can bring to environmental education. In considering some of these attributes it is usefu to return to the elements that have been shown to characterize contemporary approaches to environmental education, i.e.:

Adventurous exploration and enjoyable involvement
Extensive interdisciplinary participation
Problem-focused decision-making experience
Future-orientated experiential learning.

These four overlapping themes will each be reviewed in turn and although the emphasis will be on the relevant advantages likely to accrue from such a simulation approach the chapter will conclude with a number of practical reservations.

1. Enjoable exploration

A heightened interest and excitement in learning

Increased student motivation, stemming from heightened interest in the teaching and learning process, is a commonly reported phenomenon following simulation exercises. Without doubt, this is the clearest and least disputed gain attached to simulation in the classroom, despite the difficulties of measuring it. It seems to apply at widely differing levels of learning.

This one quality alone is seen by many as sufficient reason for continuing to pursue simulation experiment and development. The body of opinion on this point is uniform and impressive; but the question of why simulation arouses and sustains a high level of interest, enthusiasm and excitement is relatively unresearched.

The divorce from 'convential wisdom'

Faced with a simulation situation, participants often have little previous experience and precedent to support them in such a novel context. Even when the student has had some previous experience of simulation techniques, there is little likelihood that there can be conscious transfer of strategic ideas. Consequently, a level of freshness and novelty is generally maintained.

Few participants are able to approach dynamic simulation experiences with a usable tool kit of 'cook-book' solutions or even a body of theory. Issues must be treated on their merits, alternative strategies must be devised and attempted, results observed and conclusions drawn, on the basis of direct experience.

In such circumstances, both student and teacher are frequently untroubled by preconceived notions; there are few panaceas to be found in conventional wisdom. At best, simulation becomes a channel of communication for the open-minded, tuning both student and teacher onto a new wavelength of learning.

Removal of student-teacher polarization

Pictures of classrooms from former centuries — and even from this century — graphically represent the past relationship of teacher and child: the teacher stands on a dais, pointing to board or map with a stick, children sit in rows, apparently attentive and presumably passive, except when called on to answer a question. There is a presumption of polarization of roles between the teacher and the taught.

In recent years, however, we have gone some way towards revising this traditional image. With young children particularly, more informal situations have developed where staff and pupils have become partners in corporate activity. The teacher's function has become one of inspiring, stimulating and motivating, rather than directing, ordering and judging. And this, in turn, has meant that the teacher has been coming to accept a less dominant, less intrusive role in the learning process.

Simulations are an aspect of this process and are broadly egalitarian in style. Few direct judgements on student performance are required as most simulations are self-monitoring. Opportunities usually present themselves which allow participants to recognize their own progress, or that of the group within which they are working, by various feedback methods.

Students take decisions and then observe their consequences. Their own evaluation of these consequences then influences their future actions. Given favourable progress (positive reinforcement), the student progresses to new

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challenges; given unfavourable consequences of decisions (negative reinforcement), he is likely to re-evaluate the basis of his decision-making.

Thus personal tensions and even antagonisms in the teaching situation are likely to be reduced by such a process of self-monitored learning. The teacher's role may be that of an interpreter of the simulation, and even guide, but he does not have to pose as expert or judge.

Simulation as a universal behavioural mode

Children are no strangers to games. The Opies' (1959) classic text emphasized the familiarity of the game world even for the very young; from the days of the nursery rhyme and classroom shop, children move within a familiar role-playing, simulating environment. Games thus have good associations and bring the familiar atmosphere into the classroom. The worlds of play and of free drama have a close relationship with the more structured use of simulation for learning, for the idea of putting oneself in the place of another sometimes seems easier for children to accept without inhibition than for adults.

Fines (1970), writing about simulation in relation to history teaching, made this point:

'It has for long been common knowledge that play is really a learning situation in the animal world, among primitive communities and with young children everywhere; furthermore, experimental learning has markedly better results than academic instruction in many fields; but until quite recently no one had explored the possibilities in the higher ranges of education, except for the odd military academy or business school ...
Certainly we should be turning our attention to this field ... the use of dramatic role-play in history teaching is often relegated to the position of knock-about humor at the end of term, but it could well be organized into a much more searching learning situation by developing a greater commitment to the dramatic content or to the game element.'

Acting-out and role-play procedure are age-old. When embedded in instructional simulation systems, they are cast in a slightly different mould and bring together differing combinations of media which make demands upon much of the student's range of auditory, verbal, visual and manipulative skills. Such 'multisensory' stimulation clearly has a large part to play in achieving and reinforcing the impact of the technique.

The competition involved in games is rarely seen as invidious since it often occurs between groups rather than between individuals. Brighter students are usually not penalized by their peers for showing others up — as is common in

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some classroom instruction — but are actively encouraged to improve team performance. The game activity has an age-old legitimacy which is readily accepted by children. Simulation in this sense brings a fresher non-authoritarian atmosphere into the classroom.

2. Interdisciplinary participation

An inter-disciplinary view

It must be acknowledged that the great bulk of what needs to be done to improve the lot of society will require tremendous collaboration and co-operative effort among widely diverse groups and elements. Simulation has particular advantages to offer in that it can present an integrated or synoptic view as well as provide a vehicle for free inter-disciplinary communication. If problems are under scrutiny in the simulation, they cannot stop short at disciplinary boundaries; they must be seen as total approaches to the problems. Human, economic, aesthetic and moral factors may all impinge in unfamiliar surroundings. And the fact that participants are required to see the world at least partially through eyes other than their own often helps them to be more explicit and less guarded about what they see.

The interconnection and interdependence of ideas help to generate a richer group dialogue; varieties of attitudes and points of view can be drawn together in play and de-briefing discussions. Thus simulations can present an integrated approach to environmental problems. They can bring together classes, departments and schools to examine current real-world issues. Institutional and psychological barriers can be eroded by the very newness of the technique.

Often a game can be used to bring teachers and students together. Team teaching involving more than one discipline is likely to yield a multitude of favourable 'pay-offs'. Games are available which emphasize a holistic approach and encompass various cultural, economic and political aspects of the environment. Simulation activities provide a means for welding together traditional disciplines — often left compartmentalized in the past — and can foster a problem-solving environmental ethic arising out of the widest possible collaboration.

Role awareness

Some users of simulation would claim that an important pay-off involved was that of increasing role awareness. To feel what it is like to be in someone else's shoes, and to appreciate some of the ramifications of particular types of be-

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haviour might be considered a more important objective than an understanding of the process in which the behaviour was taking place.

Games such as Project Simile's Star Power in which a change in attitude is sought, and those with extensive role biographies to be considered before the simulation is begun, might have role awareness primarily in mind. Simulated social systems, for example a local school, community or town, might well see a degree of empathy with some of the roles as a major objective.

It is possible that simulations can develop this situation, although it would seem difficult to fully implement the objective without preliminary study and considerable explanation.

The experience of Clayton and Rosenbloom in using some of the Bruner Social Studies Curriculum Project material (Boocock and Schild, 1968) may be worth quoting:

...the resultant games combined and confounded the potential of games for role-playing and strategic uses. Role-playing and strategic analysis, rather than complementing each other, turn out to be incompatible behaviours, one requires immersion and loss of perspective, the other requires stepping back and objectivity. This, and a number of other problems have become evident through the classroom trial of educational games ... Students interacting with each other in games do learn something about human behaviour, but what they learn is how other schoolchildren respond to an unfamiliar game, not how Netsilik hunters respond to an approaching caribou herd ... we believe that the fruitful path is to choose games which emphasize strategy and structure rather than personal roles.'

Clayton and Rosenbloom's point about the incompatibility of role-play and strategic development may well be an important one to note; it would seem to suggest that a simulation should not attempt to concentrate on both of the technique's potentialities at once, unless there is ample time to allow both 'immersion and loss of perspective' and 'stepping back and objectivity'. The exigencies of classroom time probably militate against such a possibility, except in the rarest cases.

Simulations are available which specifically seek to encourage pupils to immerse themselves in certain roles within circumscribed environments. Power structures are made explicit and in the good simulations everyone has a job to do. Both the shy and the garrulous have a part to play. Students can surprise themselves and often their teachers too. Traditional expectations of student performance can go by the board when pupils find themselves forced to play a *full* part in the learning process. As Jones (1980) has pointed out, the game environment

places obligations on students — their colleagues provide further poking and prodding and with pupil interaction come both commitment and courage:

"They say to themselves, 'I have to do this; it is my job'. This is an attitude of action and is in sharp contrast to the near paralysis a shy person may sometimes feel in a teacher/student situation.

In this way, a simulation provides a parallel with what happens in the outside world. Most people, for example, seem to think that newspaper reporters are pushing, persistent, aggressive and intrusive people. In fact, most reporters probably do not have this personality. Most of them are probably introverts, having entered journalism because they are good at writing. They push and persist because it is their function, duty and responsibility to get a story. But doing so also enlarges their experiences and makes them more confident, and results in a facility for finding effective ways — and not always aggressive ways ways — of getting the news. The same sort of job experience occurs elsewhere — not least in the field of education. Dedication to a job brings bravery in its execution".

3. Decision-making experience

The problem-solving process

One of the activities which is central to environmental education is problem-focused learning. In effect, problem-solving in an environmental context is theme-related. It is concerned with key decision-making processes which continue to shape man's environment. Thus students play simulation games to discover the controlling parameters of selected problem sets. In entering into this commitment, a number of the facets of the decision-making process are seen to be rewardingly revealed.

Simulation participants need first to demonstrate their ability to understand and then come to terms with their teaching environment. Often by the gradual increase of data or rule complexity, simulations can be sequentially more challenging and so call decision-making skills into action step by step.

The participant may show competitive, co-operative or irrational behaviour in his appreciation of the situation. The technique brings together not only the student and concrete environmental data, but the vagaries of chance and the effect of human relationships. The participant needs to synthesize all these and yet still see the basic problem in realistic terms.

As the participant thinks for himself about the decisions he may take during the simulation, he also comes to understand the impact and consequence of his own and others' actions. Almost every element or component in the decision-making process can be introduced. Data must be selected and organized. The relevant must be recognized and the trivial dismissed. Strategies must be invented and alternative courses of action on occasion must be planned and implemented. The occurrence of uncertainty must be taken into account and co-operation and competition organized and managed.

In these respects, simulation is potentially a very flexible and useful framework in which to practise decision-making and observe it at work. It can incorporate different levels of decision-making, diverse varieties of phenomena and considerable open-endedness.

Bridging the Gap to Reality

For many pupils in school classrooms, schoolwork seems divorced from the 'real world' in which they are anxious to live. Simulation, with its concrete approach to situations, may well be a major tool in the attempt to bridge the gap between these two contexts.

The participant may have a chance to sample the real world in the simulation and yet may be observed taking real-world type decisions in a risk-free environment. There is no danger to himself, to others; he can make his mistakes and learn from them, and perhaps later apply their insights in similar or in relevant real-world contexts.

The very success of a simulation in this sphere can sometimes be its undoinn. If students have been highly involved in a situation, the interest of the situatiog itself may be uppermost in their minds rather than its analogue in reality.

As Shirts (1970) has commented:

'...games are vulnerable in a way that textbooks aren't. Because the interaction between participants is genuine, there is a temptation to conclude that the model, the facts, and everything about the game are also genuine.'

He goes on to discuss this in relation to war-gaming, and the difficulty of seeing the game as something other than a basically enjoyable experience. The same point is reflected in Andrew Wilson's (1968) review of simulation techniques, and in his criticism of their shortcomings. Shirts gives an example:

...there is a real danger that games about the black community, which are written generally by persons from the suburbs and are based on a series of

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unfounded clichés about what it is like to be black, not only encourage stereotyping but create an attitude of condescension towards blacks. More importantly, they can give the students a false feeling that they actually know what it is like to be discriminated against or what it is like to be black. Such games should not be played unless there is extensive input from the black community through talks, films, literature, personal confrontations and discussion...'
(Shirts, 1970)

The bridge to reality, in other words, can be destroyed either if the model itself is a false one, or if there is insufficient attention in linking the simulation experience with the reality on which it is based.

Suspect models are most likely to be used if there is a shortage of models from which choice can be made, and if the user is also perhaps the originator. The need to pre-validate models by careful testing points up the importance of the model-builder in this situation. The educator uses his greater experience to develop models for use with students; but if they lose verisimilitude in the interests of entertainment or ease of operation, their responsibility for supplying false information is considerable. The seductive powers of simulation can be used for bad purposes as well as good.

In developing simulation as a technique, it is not as contrast to case-study material but as support for it. The belief would be that case-study material used after a simulation would be more relevant, more easily comprehended and more likely to be remembered. But it is no doubt possible that the heady wine of the simulation experience may make this of less long-term importance. Without research done over the long term, we cannot know.

Problem-solving relevance

Most simulations have a strong problem-solving orientation. Games help to make learning an active process. Students actively participate in shaping the evolution of a situation as opposed to passively listening to the teacher or mindlessly seeking to memorize abstract pieces of information. For example, the Spring Green Motorway gives players specific roles in relation to a village with various individuals considering whether to support or oppose a proposal to build a motorway nearby. The game Streets Ahead involves teams of pupils in deciding how to develop their particular street. A board is used to map out the street and provides opportunities for building new shops or amending housing layouts. All these examples are simple and very clear learning tools enabling students to see immediately the relevance of what they are doing in the classroom as it relates to the changing world outside.

A problem-solving orientation is basic to simulation activities. Game participants have to acknowledge the perceptions and conventions upon which survival decisions often rest. The classroom can provide opportunities for practising ways of coping with problems of the world of work. Pupils can learn to recognize essential inter-relationships between cause, contingency and chance in shaping tomorrow's environment. Simulations give pupils the opportunity to have a trial run, to apply knowledge already learned and to build up confidence as they improve their performance. Such opportunities are rarely available in other ways and that is why many professional training programmes for environment interests have found a place for simulation activities.

Closely related to the build-up of decision-making practice is the discipline which comes from being systematically encouraged to think through carefully staged problems. In this sense, simulation is essentially a process for learning to develop *a feel for* and *an insight into* evolving situations. This abstract quality has been touched upon by Raser (1969) who has likened gaming participation to

'the architect, who, before he arrives at a final design, tries to imagine himself *moving around* in his building, who tries to *experience* it rather than simply peering at if from the outside, it may be that the student of social processes gains a more meaningful comprehension of those processes by getting inside them, by experiencing their dynamics in the microcosm of the game, instead of by looking at them from the distance of a book or a lecture.'

In short, simulation decision-making experience is one method of cultivating a well-rounded appreciation of the dynamics of the total situation!

4. Future-orientated systems

The dynamic framework

A shortcoming of much education is its obsession with the past tense. If environmental education is to have real meaning the future tense must be embraced and set alongside the present tense. Simulation is one of the few classroom techniques which come to grips with time, be it past, present or future. A large number of time perspectives are possible within a single simulation and the greater the compression of time, the sooner participants are forced to continually acknowledge the dynamics of change. Sometimes these perspectives are clearly defined so that, for instance, one round equals a three-month or six-month period; at other times, the teacher may develop the time analogy by signalling the passage of days or weeks on a blackboard at regular intervals, as

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discussion and negotiations proceeds. In both cases the realities of actual time are being clearly translated into the constraints of classroom time.

Things 'happen' in simulations as they progress and the snapshot view of the world is difficult to reconcile with the process view that simulation tends to emphasize.

Wider perspectives

Simulation provides a counter-balance to the largely unchallenged school traditions such as note taking, copying and individual passivity. It offers a range of opportunities to use and respond to language with a clear present and future purpose. It places students in a performance context where they are no longer required to respond in isolation. For many, simulation breaks new ground in utilizing and valuing teamwork and group achievement. Educational games seek to give the learner a feeling for a wider reality. In Hooper's (1968) words:

'Like the good museum, they can get beyond the limiting two dimensional views of reality in the traditional classroom. As with the good film or television lesson, games can heighten the "You are there!" emotion. Instead of looking at an historical character from the outside, you can become the character and try out his role ... In addition to reading and talking for example about the legislature, it is possible via games to "live" it. A legislative game developed at Johns Hopkins makes each player an elected member with the task of getting re-elected. Each player is dealt cards which show the preference of his constituents on certain issues. He then works for or against these issues in the legislature. He is re-elected or not according to the number of satisfied or dissatisfied constituents as a result of his voting record. Too much of the reality in the classroom comes second-hand to the learner. Knowledge is filtered by the textbook and the teacher. But with games the learner is confronted more directly with the primary sources. Gaming is thus close in flavour to the discovery method.'

An obvious defect in conventional education is the neglect of dynamic frameworks and wider perspectives. Actions, reactions and their consequences are too often widely separated. Few students see the relevance of basic skills to their later life. Rarely can the classroom draw together time and space so that future 'worlds' can be brought into the present and strange — not to say alien — roles can be experienced first-hand. Simulations offer this facility and more specifically stress the dynamics of life. In Peter Gould's (1969) words:

'They hammer home a message:

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"Don't just sit there! Think about the future of your land. Is the present course of events going to lead to the world you want?"

'It is a message adults ought to be getting too!'

5. Interpretative comments

In conclusion, it should be stressed that the case presented so far is a personal view. Though simulation activity is growing fast, it is still in its infancy and has its teething troubles and a restricted amount of experience. As yet there are few discernible simulation results which can be viewed as standard reactions. Clearly, the properties reviewed above do not in themselves validate instructional simulation systems as a whole. Promise still needs to be exploited and tempered with scepticism.

The time factor

It is a frequent cry of the classroom teacher, that time is the enemy of progress, and that the introduction of new ideas is seriously hampered by the lack of available time and also because of examination demands. Simulations, however attractive, are time-demanding activities and must therefore prove themselves to be of high value in order to justify a place in the timetable, since their use may cut out other learning opportunities.

An examination of the nature of some simulations seems to confirm this problem. Despite the careful development of an analogue to an important process, there may well be a good deal of time spent on apparently inessential activities — filling-up forms, getting people organized into groups, shuffling cards and papers, explaining aspects of the simulation to those who do not understand.

The problem of time is more of a constraint in the school than in the college. A teacher with a class for two forty-minute periods a week will think carefully before setting up a simulation; a college lecturer may have a day to develop an idea with a captive audience — or even a period of several weeks in which their energies can be concentrated on the job in hand. While the almost ritualistically defined timetable divisions exist in some situations, it is likely that simulations may be relegated to optional 'after-school' activities or end-of-term diversions. But not all simulations are elaborate or extensive, and it is likely that simple versions of the technique will be of initial use in a classroom, whatever their crudity in design. Movements towards greater selectivity of material in curricula, and towards the desire to study material in depth rather than breadth may make it possible for this disadvantage to be less crucial in the future.

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Learning at diverse levels

Present information concerning the learning impact of simulation is fragmented and based more on hunch and general impression than on systematic validated research study. This is partly due to the comparative novelty of the technique and to the fact that authors of evaluation studies are often the originators of the simulation or game under review.

One of the most substantial evaluation programmes has been carried out by the Center for the Study of Social Organization of Schools at Johns Hopkins University, Baltimore. The Center had an Academic Games programme as one of its major activities, and a team of researchers have produced a number of reports on simulation experiments. These vary from Schild's (1971) study on the influence of games in the school achievement of 500 Israeli children (an indirect effect on attitudes and abilities was noted), to Kidder's (1971) Study of the emotional arousal and mood changes of students during a game. Some of the Johns Hopkins studies show significant improvement in the learning of facts and concepts, but not all (Livingston et al., 1973).

Another valuable collation of research evidence in the social sciences was made by Chapman, Davis and Meier (1974). It was, like the Johns Hopkins summary report, cautious in offering generalities related to the evidence at hand.

The use of simulations in the classroom often implies a change not only of technique but of objectives in relation to what it is intended the pupils should learn. By their very nature, many simulations would be oblique in teaching factual material; yet it is this which normally forms the basis of 'learning' that is tested at the end of experimental studies. Other forms of learning are less susceptible to research testing procedure.

It should be pointed out that many users of simulation would not wish to evaluate its learning possibilities separately from the other strategies which make up the teaching unit in which it is included. They would argue that the simulation acts as a stimulus to subsequent learning and that this spin-off interest can properly be considered as part of the benefit of the technique, even though it may be developed through more traditional methods of learning.

A number of simulations appear to have been useful with both gifted and slow learners at the same time (Gordon, 1970) and in higher education, inexperienced students and seasoned professionals also seemed able to learn from each other (Abt 1974). It is in this type of learning activity that benefits accrue widely. High flyers are motivated to progress to even greater heights without adverse effect on the less gifted who, in turn, learn from their peers and pursue their own course as fits their inclinations. If simulations involve group decisions (with

students simulating the board of a manufacturing company, the government of a country or the editorial team of a newspaper) there is also the possibility of learning not only about the process under scrutiny in the simulation, but about the external influences which shape it.

Operational problems

The use of simulations in the classroom may be unfamiliar not only to the students themselves, but to the teachers and parents of the students. The initial use of such material may pose problems of logistics, operation and general acceptance. The development of much informal learning and group activity in the early stages of education has allowed students to adjust to more liberal methods in the secondary school with a minimum of reserve, but it is still possible that the novelty of simulation may cause variations in behaviour which err on the side of either high-spiritedness or inhibition. The strong element of participation which is needed makes this inevitable in some early stages, but it does not seem to be a sustained reaction, if the teacher asserts a moderating role in the situation. Group-discussion techniques in relation to chairmanship, for instance, may need to be elaborated before the simulation, but the general involvement in the simulation situation is usually a self-regulator against possible disorder.

Perhaps the bigger problem is for the teacher to exercise suitable management techniques, since at many of the key points in the simulation, he may need to deal quite quickly and clearly with spontaneous problems which are raised by the players. This unfamiliarity with the management role for teachers is something which is the subject of much in-service training in the current decade. In many cases, finding the initial courage to experiment is the major barrier, and once a simulation has been attempted, other experiments and improvements quickly follow.

One of the biggest problems may be the classroom furniture. Immovable desks or laboratory benches do not make informal discussion easy; rooms of great size make it difficult for 'master plans' or visual aids to be seen effectively by all. Wherever possible, groups should be provided with duplicate copies of material which is to be used for general visual display; otherwise there may well be problems as large numbers of students crowd around material in an attempt to obtein information.

It may also be wise to consider the relationship between school and parents. At first sight, and unless forewarned, some parents may find it difficult to appreciate and accept the relevance or intention of classroom simulation. (One

senses that drama teachers in schools face similar problems — 'I'm not sending my lad to school just to play-act,' said one parent, in an interview with a headmaster at a school where simulations had been used.) The results of commercial exploitation of games may have left the impression that they are nothing more or less than a diverting entertainment. Judicious display, or even a chance of participation at a parents' evening, may be useful in gaining co-operation rather than hostility.

6. Concluding remarks

Simulation activities like environmental education itself demand that we learn to think and act in new ways. As stated previously there is no magic formula for introducing or using simulation or environmental education for that matter. Both present a comprehensive view rather than emphasizing specialization and narrow views of reality. Both also maximize participation and experimentation opportunities. What is at stake is a new form of classroom instruction centred on *innovative learning*.

This point should not be overlooked. Our concern is with something more than just a new teaching method or with a different medium of instruction. A fundamental change in attitude is required with respect to how learning can and should take place. Teaching strategies henceforth may have to take account of new concepts of *learning environments*. Instructional simulation systems can be seen as but *one* of these new educational arenas. The concern of the present work has so far been with the evolution of a promising means to engage, motivate and stimulate students beyond the usual levels of commitment. It may well be that simulation activities have an important supplementary role to play in *learning how to learn* in environmental education. If one accepts that simulation might have a significant supplementary role, it would be misleading to pretend that the nature of this commitment has as yet been thoroughly described or researched. For example, although more and more environmental games appear each year and the repertoire of gaming structures goes on expanding, it is plain that today's range of procedures may not be representative of tomorrow's formats and uses. It may well be that many of today's simulations may be superceded by more sophisticated models appropriate to specific settings. Certainly the technology supporting such developments shows every sign of continuing to improve as does the discrimination of the user.

Like environmental education, the art of simulation has progressed rapidly in the last decade. Progress has been monitored in both areas by the setting up of significant institutional organizations as well as by the publication of acclaimed

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specialist magazines and journals. Clearly both activities have come through their initial gestation period with surprising support and vitality.

But it is important to remember that a great deal has been developed and achieved in a very short space of time. The early findings of pioneers have been sufficient to encourage further work. Much could be gained from increased and more varied experimentation with some of the simulation ideas and structures that have already proved their worth. More might be achieved in the short term by exploiting what is already available rather than searching for new base models. Certainly, it might be useful to examine these existing models in wider educational contexts, since a change in the sequence of work or the use of simulation in a different context may reveal the full potential of the base model and in turn do much to improve the impact of an innovative approach to *learning how to learn.*

The key to achieving immediate progress may well stem from a fuller appreciation of knowledge that already exists in the system — but at present only recognized by a few. Many more environmental education interests need to be made more aware of the technology *almost* at hand. The expertise of the comparative few must be more widely and more quickly diffused. It is hoped that this book might serve to expediate this process and provide a basis for environmental education programmes which in Wolsk's (1972) terms:

'seek to encourage pupils to look at their surroundings and their own place within them with a more practised eye, a more involved heart, and a more responsive mind.'

PART TWO

Selected environmental simulation examples

Introduction

This section is intended to provide general guidance and clear basic instructions for those who wish to become operationally committed to environmental simulations. All the examples have been chosen because they are illustrative of tried and tested material which is both *simple* and *effective*.

It would be impossible to achieve a complete cross-section of styles and types of games and simulations already discussed in Part One. However, the material that follows does cover a wide variety of *simulation approaches* and does give an indication of the expansiveness of simulation in environmental education both in terms of its concerns and its relevance to differing age levels.

No one game or simulation considered here is addressed to a narrow view of one aspect or area of environmental studies. Most approaches and models take a holistic view and hence the categories covered by each example is best summarized in the table given below.

All the models presented are not only simple but they are in many ways '*frame games*'. That is to say they are 'priming models' or robust frameworks which can be readily adapted or developed to suit many other situations. For example, Spring Green Motorway is a very basic model which has different locational counter parts in Motorway (Walford, 1973) and the Motorway game (Martin, 1980). This type of simulation can be quickly elaborated and to demonstrate something of the range of options open to immediate exploration Rew Walford has, later on in this handbook, reviewed alternative development paths for The Carribean Fisherman example. Space is too limited to allow indications of future possibilities. However, it is not difficult to accept that self-instructional simulations might become more common and rewarding as a consequence of the development of micro-chip technology. Playing television games and drawing on television data files might bring about a rapid expansion of 'interactive home learning packages' using slightly more sophisticated versions of the same household equipment.

For the moment the emphasis here is on a *very basic scissors and paste ap-*

proach. Jeff Bishop's Houses Game is remarkably cheap and economical to use — and yet like most simulations it is capable of considerable elaboration.

Inclusion in this text has been determined, in part, by the availability of inexpensive packages/kits/and follow up material from international non-profit agencies such as the Oxford Committee for Famine Relief and Community Service Volunteers.

Finally, it must be emphasized that the material presented is of an introductory nature. As already noted, the games proposed as concrete examples are not directly applicable to all local situations. They constitute essentially a frame of reference for synthetizing the methodological guidelines already developed, as well as a point of departure for the design of games adapted to specific environmental and socio-cultural conditions. Consequently, the reader is confronted with a challenge — can you design your own game or simulation? Once again, basic guidance is provided to both curriculum developers and teachers.

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Plans for Motorway rock Spring Green

from our reporter, June Finlay

Spring Green, a picturesque and charming village on the main London to Eyemouth road, is viewing the publication of plans for the new M19 motorway with mixed feelings. Some local residents are up in arms about the whole business, whilst others are claiming that the motorway will make the village a safer, quieter place.

This week I went to the village to get the opinions of local residents, but found, and I must admit, to my profound relief, that Councillor Ferguson, Spring Green's representative on the Ildridge Council, had already thought of doing just that, and has called a public meeting, which is to be held shortly in the village hall. Councillor Ferguson informed me that he would like 'all interested parties' to attend. He has already written to the Department of Transport and the Department of the Environment, asking them to send representatives along. He is extremely hopeful about getting favourable replies from them.

NOISE

The first thing that struck me about the village was the tremendous amount of noise, coming particularly from heavy lorries, in the central part of the village. Rev Bloggs, local Chaplain, told me that noise and vibration were causing considerable structural damage to his church, situated just by the main road. However, one local resident who also lives right by the A74, Mrs 'Stonewall' Stone, as she is affectionately known, said 'I've lived here all my life, and the traffic noise has never worried me.'

WON'T BUDGE

Mrs Stone went on to say 'They tell me that my house will be demolished if the new road is built, but they will do it only over my dead body – I shall stay here until they drag me out.'

CROSSING DANGER

'Tough words indeed, but there seems to be quite a body of opinion in the village which is for the motorway. Mrs Berry, who lives on the council estate, told me about the fears which she has about the fact that her children have to cross the busy A74 twice a day on their way to and from school. She said 'Five children were injured on that road last year, and of course everybody knows about the terrible death of young Jimmy Plant several years back.' Mrs Murphy, the headmistress of the village primary school, shared these fears, though she pointed out, almost reluctantly, that the motorway would enable people to get to London much more cheaply.

COMMUTING

Quite a few people in Spring Green commute to Minchester every day, and one of these, Mr Peter Snuffle, expressed strong views about the plight of the Spring Green commuters. 'The road is yours and the trains are expensive,' he said.

MARRIED 50 YEARS

Ildridge residents, Mr and Mrs George Ball, celebrated their golden wedding anniversary last Thursday. Still full of good humour, Mr Ball quipped '50? It seems more like 500!'

OPINION

This division in local opinion on the motorway issue is reflected by various local organisations who are now rallying forces for the fight. The Ildridge branch of Friends of the World, the environmental pressure group, has vowed to fight the motorway to the death, and in this is backed by the Ildridge Society, which wants to protect this rural and pleasant area from what it sees as the 'ravages' of the motorway. But road user and industrial interests are organising support for the road. The Minchester Road Development Group believes the road is essential to relieve Spring Green of the traffic and to develop trade at Eyemouth. In this they are supported by road builders and freight companies, who plan to send representatives to Councillor Ferguson's meeting.

All these interest groups with their battalions of facts and figures, will obviously raise the temperature of already high local feelings on the issue, and nobody I spoke to last week envied Councillor Ferguson's task in keeping order at the public meeting.

The Gazette asked representatives of two opposing pressure groups to put forward their views.

Paula Green, co-ordinator, Ildridge Friends of the World: 'The M19 is a symbol of what's wrong with national transport policy. It'll cost millions of pounds, take thousands of acres of good agricultural land and will duplicate the perfectly good railway, that we'll argue could be better used. With oil running out, we need to move away from cars, and we'll also need to grow more of our own food. This road takes us in the wrong direction, and will mean less money spent on public transport, which the half of the population without cars rely on. The road's supporters believe that the road will relieve Spring Green, but experience shows that traffic expands to fill the space available. We will be arguing for *real* solutions to traffic problems, planning so that people don't have to travel so much.'

Andrew MacAdam, chairman, Minchester Roads Development Group: 'At present all traffic between London and Eyemouth, including a lot of heavy lorries, passes through Spring Green, threatening lives, destroying historic buildings with the vibration, and creating noise and pollution. The M19 will remove these problems, and at the same time help the economy, by, in general, speeding up journey times for lorries and, in particular, allowing the light Scandinavian trade at Eyemouth, which congestion on the A74 has prevented from developing, to grow to its full potential. If the M19 isn't built, this opportunity will be lost, life in Spring Green will get worse, and the village will eventually die, strangled by its own main road.'

I Spring Green Motorway

Designed by Stephen Joseph and Nick Lester and edited by Kate Reed.
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: Community Service Volunteers — London
: Council for Environmental Conservation — London
: Transport 2000 — London
(A complete folder of materials is available from CSV, 237 Pentonville Road London N1 9NJ)

Aims

The role playing game simulates public reaction to the proposal to construct a new highway near a fictitious village. In many ways the game represents an open-ended pedagogical strategy for making explicit a variety of opinions, issues and conflicts which emerge when a major development proposal is being considered on anyone's doorstep.

Context

The game has been used and can be adapted to suit pupils from a wide range of ability groups and backgrounds. Experience suggests that the game works best with children over the age of ten and with any number of players between 23–48. As a rule, one to two hours is all that is required to demonstrate the main principles of the exercise.

Equipment

The game is a very simple one and requires minimal materials. Individual copies of 'role' and 'choker' cards must be obtained but one copy of the Spring Green map and the *Ildridge Gazette* can serve everyone if prominently posted on a class notice board.

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Operating Procedures

The situation at the outset is described in the lead story of the *Ildridge Gazette.* In short, a motorway is planned and it is announced that it will pass close to the village of Spring Green. Opinion is divided on the issue and a public meeting is scheduled to discuss attitudes and issues arising from the announcement of the proposal.

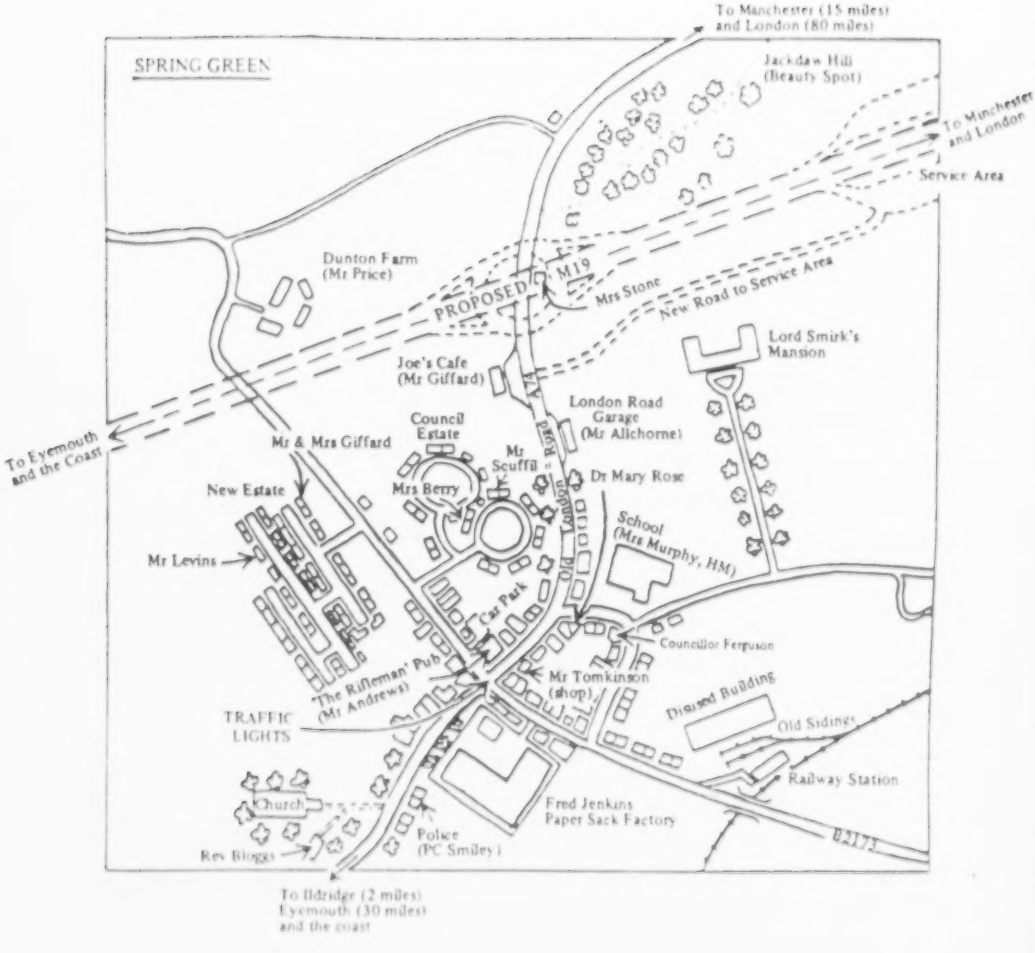
The 'role' cards should be given out to the class so that as many pupils as possible have a role to play. It is essential that pupils research their roles before a public meeting is held — the 'role' cards provide only thé barest of outlines of each of the characters involved. Pupils with role interests in common should be encouraged to explore potential collective reactions. Everyone should be advised to anticipate what others are likely to say at the meeting, i.e. they should try to imagine how they would feel or what they would do as different inhabitants of Spring Green.

Relevant research into critical issues should be encouraged. For example is it possible to provide answers to such questions as:

How much per mile does a motorway cost to build?
Do traffic noise and fumes affect plants and animals?
Will the Ministry go ahead and build if the majority of the villagers are against the proposal?

The 'choker' cards are meant to be given to pupils who do not have a role to play. If the need arises many others can be devised and issued by the teacher. Certain pupils who remain without a 'role' or choker' card should serve as the 'uncommitted body of opinion' in the village. At the public meeting, conflicting factions will be hoping to win support from this uncommitted group. However prior to the meeting, the uncommitted are expected to formulate leading questions to be raised when the meeting takes place. Some examples are given on the 'choker' cards. As more 'choker' cards are introduced, more issues are raised as areas needing additional research prior to the meeting. There is no reason why the pro- and anti-factions should not hold their own group meetings prior to the formal public meeting. At a pre-determined time, the public meeting should be held with Councillor Ferguson in the chair. He is determined that 'the wishes of Spring Green' should prevail and he wants to know what kind of stand he should take in future dealings with the County Council (the regional authority) and the Ministry (the national authority). The teacher can take Councillor Ferguson's role if the situation demands but the important point is to ensure that everyone has the same chance to state hisor her case.

It may be necessary to spread the meeting over several lessons, although to


To Manchester (15 miles)
and London (80 miles)
SPRING GREEN
Jackdaw Hill
(Beauty Spot)
To Manchester
and London
Service Area
Dunton Farm
(Mr Price)
PROPOSED M19
Mrs Stone
New Road to Service Area
Lord Smirk's
Mansion
Joe's Cafe
(Mr Giffard)
London Road
Garage
(Mr Allchorne)
To Eyemouth
and the Coast
Council
Estate
Mr & Mrs Giffard
Mr
Scuffil
Dr Mary Rose
New Estate
Mrs Berry
School
(Mrs Murphy, HM)
Mr Levins
Car Park
Councillor Ferguson
'The Rifleman' Pub
(Mr Andrews)
Mr Tomkinson
(shop)
Disused Building
TRAFFIC
LIGHTS
Old Siding
Railway Station
Church
Fred Jenkins
Paper Sack Factory
Police
(PC Smiley)
Rev Bloggs
To Ilbridge (2 miles)
Eyemouth (30 miles)
and the coast

avoid disjointed presentation it has been found useful to have a single consolidated period of time available. Finally it should be remembered that since Councillor Ferguson is seeking a mandate from the meeting, a vote (residents only!) may be seen as a fitting close to the meeting.

Over and above all normal de-briefing procedures, participants may be required to produce a report of the meeting for the *Ildridge Gazette* or a tape-recorded account for 'Ildridge Local Radio'.

Role and choker cards

The following are examples of the cards that can be used in determining roles. They are not exhaustive, and one can imagine other individuals having particular interests, for or against, in respect of the motorway project. Although the greater part of the role content applies to a European (British) community, the principle can be adapted to any community in any region.

1. Role cards

MR MARK SILVER

Role Card MR MARK SILVER

You are the director of 'Silverway Container Services Limited' transporting goods to and from Eyemouth Docks. You are currently re-equipping your fleet with heavier lorries and the motorway would be a boost to business. You're a firm believer in the motto 'where there's muck there's brass'.

DR MARY ROSE

Role Card DR MARY ROSE

You are Spring Green's local doctor and although you have lived here for five years, some of the local folk are still a little unsure of you because you are Spring Green's first woman doctor. You are particularly worried about the health aspects of the new road, especially the mental damage caused to young children by lead in petrol, and you think that the motorway's extra traffic would increase this problem.

MRS CONNIE STONE

Role Card MRS CONNIE STONE

Your house is right slap bang in the path of the motorway. You have lived in it all your life and before your husband died you had a chicken farm, which you bought from Lord Smirk's father when he was alive. You are determined to stay in your house and will go to any lengths to stop the motorway, even though the 'men from the ministry' made a fair offer for your house.

MRS ANN BENSON

Role Card MRS ANN BENSON

You are a Senior Official in the Department of the Environment. You have been asked by the Minister to report on the outcome of the meeting. You have come to Spring Green by train as you have never driven a car. Although you have a Departmental Chauffeur, you prefer travelling by train. As a civil servant you must of course be unbiased, but personally you support environmental protection.

MR JOHN SKIMPY

Role Card MR JOHN SKIMPY

You are the Director of Skimpy Construction Ltd. an experienced motorway builder and a member of the British Roads Federation. You hope to get the M19 contract. You are a businessman, keen for profit and hard at bargaining.

MR LEO ALLCHORNE

Role Card MR LEO ALLCHORNE

You own the London Road Garage. You are worried about loss of business if the new service area is built. You would be content merely to stop the service area development as you will probably get a good 'breakdown' business on the motorway. This means tht as your petrol sales decrease, your repair business will increase.

COUNCILLOR FERGUSON

Role Card COUNCILLOR FERGUSON

You are the representative of Spring Green on the Ildridge District Council. You have called the public meeting as you want to know the wishes of the people of Spring Green. You are well aware that there are strong feelings about the proposed motorway and that you have to chair the meeting firmly but fairly.

2. Choker cards

CHOKER CARD 1

'But surely there will be a terrific amout of noise from the motorway — particularly where it is up on an embankment by Mr Price's farm?'

CHOKER CARD 2

'Surely all this talk about decreasing the traffic on the A74 is false? Won't there be lots of people driving out from Ildridge to join the motorway at the Spring Green Road?'

CHOKER CARD 3

'Somebody told me that cows give less milk when it is noisy — so won't Mr Price's cows be affected?'

CHOKER CARD 4

'Why don't they improve the railways instead? Surely the railway also goes from London to Eyemouth?'

II The Houses Game:

Plan your own area

Designed by Jeff Bishop, University of Bristol

Aims

The game can be used to achieve a wide variety of objectives, some related directly to physical and social aspects of housing layout, others to the development of personal and group decision-making. At the lowest level, this game allows each individual to determine his/her own values and trade-offs in relation to the most important and personal environment of all the house. At the next level, the game can introduce an understanding — very important to children often faced with what seem to be clear demarcations — of the fact that others have different values but that these are of equal merit and are to be respected. At a third level, one can introduce the problems that are involved when a group needs to make group decisions on items for which each individual has different preferences — and the environment is a major setting for such decisions. Finally, one can deal with how (or whether) one group — adults, managers, professionals, outsiders from a different culture — can make reasonable decisions on behalf of others, perhaps even unknown others. In urbanized cultures this is the norm for most housing.

It would be unusual to attempt to tackle all these issues in one gaming session, but it should not be thought that they are in any way sequential or related to age or level of ability; each is significant in its own right.

Context

The game has been run — always with a high degree of involvement and enjoyment — with children from 5 years of age upwards and adults. With children below 9, special care is needed; hence these instructions take that age as the lowest point. The basic mechanics remain the same for any age group but the later instructions suggest differences of detail and running for different ages. Given the range of possible objectives, the game can be used in many educa-

tional settings. Issues of personal and group values are central to all environmental problems and therefore the game can be used simply for that purpose. Housing is a common theme within the broad environmental label, so that the game can fit at almost any stage in a housing project, module or course. Experience does, however, show that it is an excellent opening event because it establishes values as effectively as freehand mapping establishes personal environmental images.

The basic format can be used with any age range. The section entitled Variations and Extensions offers suggestions for lead-up work, adaptations to suit particular groups and subject settings, and ways in which the game can lead on to further work in the mainstream of subjects such as mathematics or science. The appropriate size of the group may vary considerably. In some ways, one or two players together can enjoy the game or find it useful, but that is both a luxury and a loss of the game's potential. The upper limit depends upon the willingness of the leader but it has worked well with class sizes of around 30.

Equipment

No special equipment is *essential:* the particular pattern of the house model can be reproduced from any piece of folded paper. The land is a further piece of blank A4 paper (or other of equal area) and it is unusual for players to produce more than three alternatives each. With pens and pencils, this is the basic kit. It is usual to stick down each players' final models, and experience suggests one tube or pot of glue for each 4/5 players. The leader requires a board and suitable markers, and some alternative methods require coloured pencils, felt tips or paint. A standard method of evaluation is offered in the basic game and a copy of this evaluation sheet is also attached to these instructions.

Operating procedures

Very little time and description is needed to start the game because the central task is obvious. Give each of the players the determined number of flat houses for them to fold (12 for the basic game). While they are doing this, the starting instructions can be given. Assuming that each player has received a bundle of houses and that correct folding is under way (one demonstration is usually adequate; see model overpage) the leader proceeds as follows: While the players fold the houses, each player in the group is given a sheet of A4 paper. It is explained that this paper represents a piece of land on which members of the group are — independently — to arrange their houses. It is also explained that each house has a private garden (backyard or appropriate local term), and

that *all* 12 houses and gardens must be accommodated on the land, with no overlap. The point is to find a layout (the word is explained if necessary) which is as *Attractive* as possible, as *Convenient* as possible and as *Cheap* as possible. It is further explained that attractiveness is entirely a personal judgement and that convenience is about how to find your way around, ensuring safety from cars, providing short routes and so forth. Cheapness requires a more specific brief. The cheapest arrangement is two straight terraces of 6 houses each. Slightly more expensive would be 3 or 4 short terraces at different angles, and very odd angles would be more expensive again. After that, semi-detached (duplex, or whatever other local name may be used) is more expensive, detached more expensive again and random detached the most expensive.

By this time most houses are usually folded so that it is a good time to call for attention while explaining what are described as the main rules. These are:

1. *That there should be some way of getting to every house at least by means of a path.* (This may not seem necessary, but it is!).

2. *That sunlight must reach every back garden.* (In some countries the need for shade can be substituted.) To cover this, either point to the sun or a south wall, or make up a card sun and place it on an appropriate wall. Be sure to point out roughly the path of the sun to make clear that houses can be placed at right-angles to each other and still receive sunlight — see illustration opposite (Even 10-year-olds realize that they can move their "land" around to improve sunlight — this is allowed and can even be mentioned during the game if individuals miss it.)

3. *There must be some public open space* for such things as play areas. This may be located anywhere, in small areas or in one large area. Gardens can also be made bigger.

The three objectives — attractiveness, convenience and cheapness — and the three 'rules' — 1 to 3 above — should be written on the board by the leader. At this point the game can start. Depending upon the progress of the game, it is a good idea to draw the group's attention to the board where the leader writes up a few 'things to think about' (these are not rules). They can vary considerably but the following list may prove useful as a general example:

— Deliveries, Postman, Safety, Noise, Drains;
— Landscaping (trees, bushes, etc.), Climate, Wheelchairs and/or baby carriages, Front Gardens, Privacy, Bicycles, Vegetable growing, Energy Conservation, Hearses, Finding one's way around.

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These items are best combined in two or three 'bundles', attention being drawn to each new bundle along with a reminder about the rules.

1. The group should be told that in *x* minutes' time (this is best judged once the game is under way) they will be sticking or gluing down their preferred solutions so that:

2. Everybody can look at and score everybody else's solution.

As individuals finish, they should be given an evaluation form and told to make sure that the model is correctly oriented in relation to the sun. When the last sticking down operation is finished, the evaluation process is described.

It must first be stressed that nobody is going to win and secondly that the method is only a rough guide and hence is best done very quickly. The three horizontal lines and scales on the 'assessment sheet' (see page 126) must be explained. Players should be told to go around the room (an easy route having been chosen) and put three ticks on everybody's form except their own. Each model should receive a tick depending on how attractive they think it is, a tick for how convenient and a tick for how cheap. It should be emphasized (although this is rarely effective) that they should score the models without being influenced by comments or by where most of the ticks have already been placed. With the scoring process is under way, players should be reminded of the relative cheapness of certain layouts.

While scoring is taking place, the teacher should walk around the room to seek solutions representing extremes — usually random detached and regular terraces — and one or two interesting middle-range ideas. When scoring is complete, everybody returns to sit with his or her own model and form. No counting is necessary, a glance at the number of ticks in each box makes a broad result quite clear. The following are some key questions to ask:

For whom were you designing? Yourself, your family, other people generally, other people specifically? Have you considered old people, the disabled, teenagers, very young children and so forth? Both the assumptions and the differing needs of each group should be discussed.

What are the basic alternatives? The leader should select significant examples noted earlier, preferably asking the designers to say what they thought most important. He determines who agrees or d sagrees with priorities, eg. for parking at the house, and points out that there cannot be a 'right' answer because different people have different needs and value different things.

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Were the rules good or should there be others? Sunlight is usually a major constraint: how many of the participants or their families would insist on it as a 'never-to-be-broken rule?' Were some items missed out, (eg. the surroundings), should something like energy conservation be included in the rules?

Did they enjoy it?
There have been hints in the text about the timing of the game. The minimum total time would be 1 1/4 hours, a recommended time 1 1/2 and, without extras as in the following section, a likely maximum would be 2 1/2 hours. The introduction/folding period can be handled within 15 minutes, the sticking-down time (which is still playing time for most) cannot be less than 15 minutes, 1/2 hour for a discussion is reasonable, the remainder being direct playing time (i.e. 1/2 hour in the recommended time).

Variations and extensions

The ideas in this section are probably as important as the instructions for the basic game because it is through the use of the variations that the game can be related closely to a wide range of educational situations. The section is divided into two parts; firstly, adaptations within the basic game; secondly, extensions of the game describing ways of using it to relate to more traditional school subjects. The lists are in no way exhaustive and several ideas may be combined.

1. Variations

A. It is surprising how much the game changes when each player has only 10 houses to get onto the 'land' or if a slightly larger piece of 'land' is used. Further changes in house numbers or land size can be introduced either to make selected points or to relate to local environmental conditions.

B. Instead of 12 houses, one can be 'removed', i.e. converted by folding the garden inside the house so that it becomes another sort of building. Each player then has to select a use and location for the other building: shop, meeting hall, food store or whatever he/she wishes. Alternatively the leader can select the building. Necessary items to service the building can be a good item for later discussion, especially in relation to ideas as to who is being housed.

C. Although the game is best performed individually, it can involve small groups of 2/3/4 although probably no more. Each group tries to imagine solutions for diverse population categories — disabled, old people, energy

conservationists, commune or religious community, and so forth or according to specific criteria such as sun-lovers, sun haters, low-income families, non car-owners, waterside site. The group may discuss amongst themselves the implications of their particular task — all roofs facing south for energy conservation perhaps — but individual solutions are still produced and the first part of the final discussion involves trying to guess, what each group represents. (Any of these briefs can of course be given to the whole group.)

D. The list of rules and objectives can be changed to relate to local conditions or specific teaching aims, e.g. by adding climate to relate to geography teaching. Similarly, in scoring, certain criteria such as privacy may be added to the evaluation form.

2. Extensions

A. *Mathematics:* This is very dependent upon the age of the children involved but a few tasks can be common to all ages and are merely carried out more fully and accurately as age increases. Once the basic game is complete, each player takes another sheet of paper, preferably very thin or transparent. On this each draws an accurate version of his/her design (one spare house to draw around can help), using agreed sizes for garden area and widths for roads and paths. Once this is done, graph paper can be placed underneath and an estimate made of the area taken up by gardens, open spaces, paths and roads (the leader should have calculated the fixed areas of site, houses and parking spaces). Younger pupils unused to area calculations can simply count squares but for older pupils, actual areas can be used (the scale of the site and houses is approximately 1 : 200). Younger pupils can produce simple bar charts to see who has the most and the least road space, the most and least open space and so forth. Older children can put all their figures into percentages — in fact the technique is in itself a good way to introduce percentages — and make the same comparisons. If topological mathematics is being used for older pupils, certain key formulae can be demonstrated which generate solutions using the least road space or producing the most open space. Clearly, many basic concepts of geometry can be demonstrated, particularly the more complex geometry involved in sun/shadow angle calculation. (The latter can also be demonstrated by using a strong light pointing at the models from selected angles.)

One final suggestion is to evaluate 'convenience' mathematically by measuring footpath lengths, carry distances and so forth.

B. *Language* — Nearly all games develop language work but specific benefits can come from selected vocabulary and from creative writing generated by the solutions: 'what would it be like to live there', 'imagine you are a house and describe what happens to you in a typical day', and so forth.

C. *Science* — Any work on houses may involve time spent on building materials, construction techniques, determining how structures stand up or what happens when weather affects a building. There are a number of issues relating to physics which may emerge from testing such things as beams or roof structures or from looking at how insulation works: is brick better than stone, wood or thatch? Chemistry can be related to the action of sulphur-rich rain water on timber or metals, or to a consideration of the various fixings used in construction such as cement or glue. Biological ideas may arise from the study of plant growth on the different sides of a building (in or out of shade) or from looking at the development of lichens on walls sheltered from wind.

A crucial issue might be energy conservation, especially as even very small aspects such as draught-proofing can relate quite closely to major decisions on housing layout, and conservation covers all branches of science.

D. *Art* — Once complete (or preferably before being stuck down) houses and sites can be coloured, decorated and detailed with roofing, gardens, trees, cars and so forth. Moving away from the paper models, more developed drawings, paintings or models can be produced and a more technical approach can provide a lead-in to reading production drawings done by architects, engineers or builders. Alternatively, the paper model designs can be used as a source for drawings of the housing showing all the detail which would be apparent in real life — 'architects' perspectives'!

E. *Geography* — The ability to read maps is central to geographical learning and many experts now suggest that 'maps' should be approached through studies of smaller-scale places such as the classroom or the school building. Many people — even adults — who claim to be bad at map-reading, in fact do well at the Houses game and it can be a powerful lesson simply to draw around a few paper houses, brush them aside and reveal a map or plan. This works well with younger children but can also be extended to develop ideas of contours, notation and coding (*x* equals church, for example).

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Much of modern geography covers movement patterns, often on a large scale, such as city transport or rural population migration. As with maps, the house models can be an excellent introduction either through the construction of diagrams showing, say, how many people will go along a path to the shops or, more simply, through trailing threads to give an immediate idea of density build-up. If this is done with a group of models, various routes can be compared and points of congestion or ideal solutions can be found.

III. The Poverty game

Adapted by OXFAM from the original devised by Jim Dunlop of Jordan Hill College of Education, Glasgow.

Complete kits available from OXFAM, 274 Banbury Road, Oxford OX2 7DZ, England.

Aims

The game is designed to teach students about the survival difficulties of a typical West African subsistence farmer. It aims to give a simple appreciation of:

(a) The vicious spiral of misfortune, poverty, malnutrition and disease;
(b) The difficulty of taking decisions, particularly when the subsistence farmer is so vulnerable to chance.

Context

Playing the Poverty game provides a basic introduction to the kinds of survival problems faced by African farmers. The game highlights the overwhelming odds faced by poor farmers in the third world and focuses on the particular impact of disasters, disease and malnutrition.

The game can provide a basic introduction as an entity in itself and as such has proved particularly useful to visiting speakers with third world experience. In such situations the game dramatizes a range of difficulties which have economic consequences and immediate relevance to most children over the age of 14. The game is weighted so that it is difficult to survive and the farmers have to take big risks to do well. As a consequence it is both gripping and challenging.

Equipment

With the exception of multiple copies, pencils and two dice all the materials are provided on the following pages, i.e.:

Table 1 — Crop Table
Table 2 — Work Sheet (2 samples)
Table 3 — Effect of Malnutrition & Illness Chart
Set 1 — Disease Cards (15 cards)
Set 2 — Disaster Cards (16 cards)
Set 3 — Help Cards (5 cards)

Operating procedures

(a) Players divide into small groups representing an African village.

(b) They start the game by studying the Crop Table to determine which crops to plant on the 10 fields the village has (Table 1).

(c) Then, by the throw of a die, they determine the weather condition for the first year of the game (Table 1).

(d) Subsequently, they work out the yields according to values shown in the Crop Table (Table 1), write yields in the table shown in the Work Sheet (Table 2), calculate their cumulative amount and fill in the line of the work sheet reserved for Food — Total possible production.

(e) They then determine production loss due to illness and malnutrition, and fill in the line of the work sheet reserved for this. Loss due to malnutrition depends on the level of actual food production and the amount is shown in the second column of Table 3. (For the first year of the game, players use the same procedure to determine loss from last year, but on the basis of total possible food production.) Loss due to illness also depends on the level of actual food production, and it is determined by the throw of a die according to rules given in the third column of Table 3. (For the first year of the game, players use the same procedure to determine loss from last year, but on the basis of total possible food production.)

(f) Players then take a Disaster Card and if the loss indicated in the card is applicable to the crops selected, they write the amount lost in the line of the work sheet reserved for it.

(g) Players now calculate any food stored from the previous year. If the total possible food production less the consequences of illness, malnutrition and disasters is more than 500 food units, the village can store up to 50 units in a year. (For the first year of the game, players apply the same rule to calculate the amount of food stored from last year.)

(h) Players calculate actual food production by deducting loss due to illness, malnutrition and disasters from, and adding the amount of food stored to, total possible food production.

$$\begin{array}{lcl} \text{Actual food production (year N)} & = & \text{Total possible food production} + \text{Food stored from last year} - \\ & & \left[\begin{array}{l} \text{Loss due to illness} + \text{Loss due to malnutrition} + \text{Loss due to disasters} \end{array}\right] \end{array}$$

Villages producing less than 250 food units in two years may draw a Help Card to see if other villages or agencies will help them. Those villages producing less than 200 units are assumed to have been annihilated.

Note 1 Card sets should be shuffled and put in three different plots according to their nature, with the content side hidden (as in any card game).

Note 2 The basic cycle is repeated for six rounds, representing six years, production levels being calculated for each round and crops rotated if so desired. Consequently each round repeats the following steps:

(1) Planting crops.
(2) Determining the weather impact.
(3) Working out crop yields.
(4) Adding up total possible food production.
(5) Deducting loss due to malnutrition and illness last year.
(6) Taking disaster card.
(7) Adding food stored from last year.
(8) Finding actual food production.
(9) Filling in malnutrition and illness for next year from chart.

Note 3 *The OXFAM Youth Department suggest the following questions to open up post-game discussions:*

(a) What has occurred to you during the game that you had not thought of before?
(b) Which villages did best? Why?
(c) Which villages fared badly? Why?
(d) Why are farmers in the poor countries poor?
Is it because they are lazy or stupid?
(e) Is the same true in reality?
(f) Did any villages co-operate? If so, why?
If not, why not?
(g) Which were the best crops to grow?
(h) In this game, misfortunes are carried over from year to year, more than prosperity. Does this happen in poor countries?
(i) What did outside contribute? Did it put people back on their feet?

TABLE 1

Crop Table

		Yearly Weather Conditions	
		Food Units	Food Units
	Crop	Wet	Dry
ROOT	Yams	70	20
	Cassava	40	60
CEREAL	Maize	60	30
	Millet	30	50
PROTEIN	Groundnuts	50	30
	Peas	40	40

Your village has 10 small fields. In these you must grow at least 3 different crops for variety in diet. You must grow at least 2 fields of protein crops.

TABLE 2
WORK SHEETS

LEARNING OBJECTIVES	Statements that describe the desired characteristics to be achieved by each child	PROJECT WORKSHEET
ACTIVITIES	Statements describing the activities children will be involved in to accomplish the learning objectives	Conditions necessary to perform tasks
LEARNING METHODS	Statements of the methods to be utilized	Materials necessary to perform tasks
EVALUATION CRITERIA	Statements that describe the method of evaluating student work	

A worksheet for planning and evaluating group environmental projects

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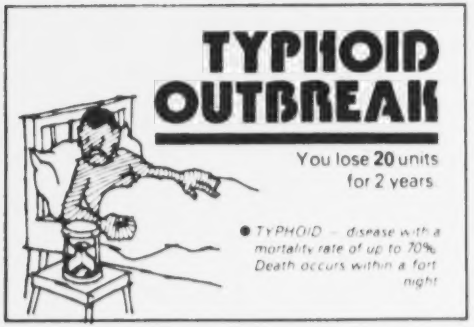
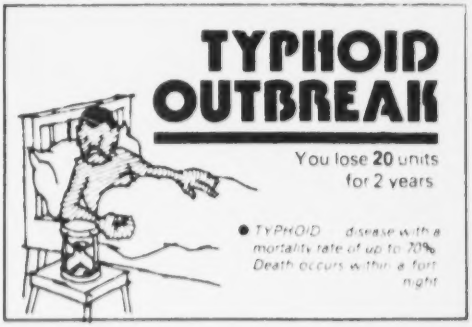
TABLE 3
EFFECTS OF MALNUTRITION AND ILLNESS


TYPHOID OUTBREAK
You lose 20 units for 2 years
● TYPHOID – disease with a mortality rate of up to 70%. Death occurs within a fort night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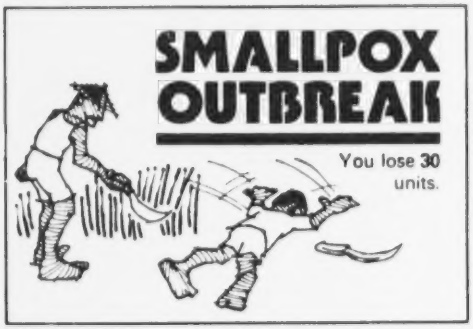
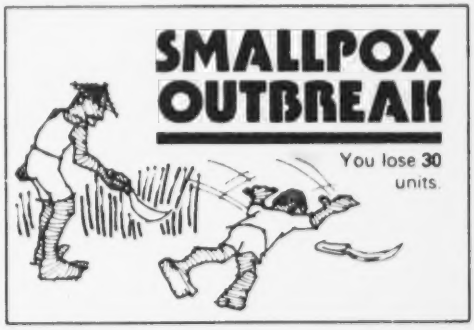
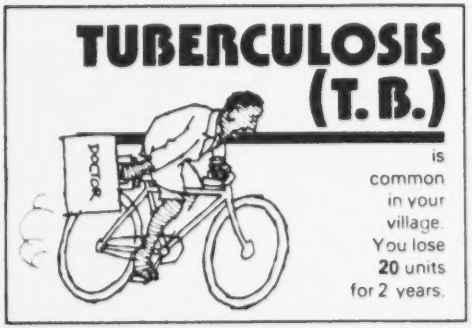
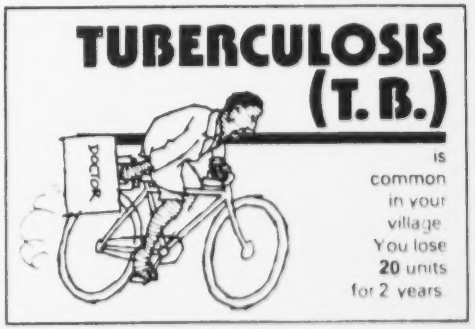
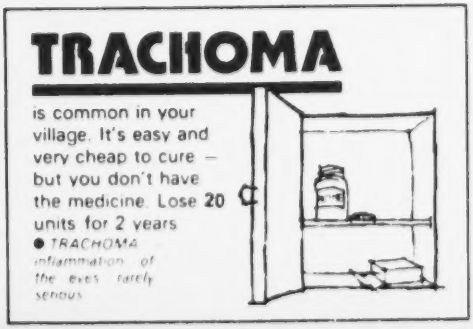
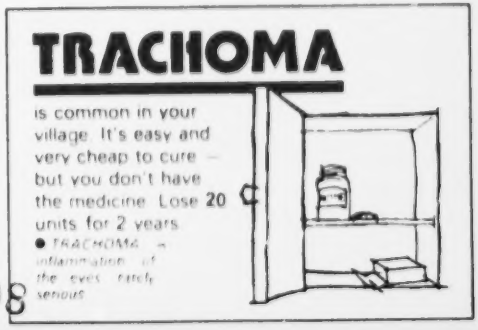









TRACHOMA
is common in your village. It's easy and very cheap to cure – but you don't have the medicine. Lose 20 units for 2 years
● TRACHOMA – inflammation of the eyes. rarely serious


TRACHOMA
is common in your village. It's easy and very cheap to cure – but you don't have the medicine. Lose 20 units for 2 years
● TRACHOMA – inflammation of the eyes. rarely serious

SET 1
DISEASE CARDS

GASTRO-ENTERITIS

is common in your village. You lose **20** units for 3 years.

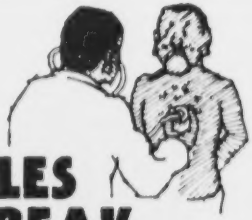
● *GASTROENTERITIS – disease of the digestive system caused by unhealthy diet*

MENINGITIS OUTBREAK

Lose **20** units for 2 years.

● *MENINGITIS – inflammation in the brain causing head ache, fever and disturbed vision*

Lose **10** units.



MEASLES OUTBREAK

WORMS

You have worms, so you have even less energy. You lose **20** units for the next 2 years.

● *Parasitic WORMS are very common in the tropics. The largest, the tapeworm, can reach 30 feet in length*

YAWS

You suffer from yaws, tropical ulcers. Lose **20** units for 2 years

● *YAWS – large yellowish sores, up to 6 inches across covering the whole body*

FLU

is common, leading to pneu-monia. Lose **10** units for 3 years

FLU

is common, leading to pneu-monia. Lose **10** units for 3 years

SET 2
DISASTER CARDS

NORMAL HARVEST

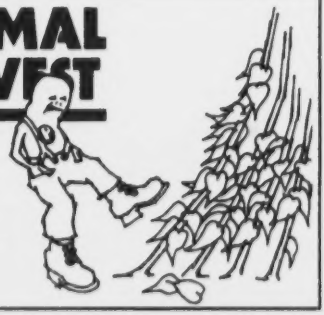
– but wild pig love maize. Everyone loses **10** units from each maize field.

NORMAL HARVEST

– but storage of food is a major problem. Your store is damp. **25%** of yams rot.

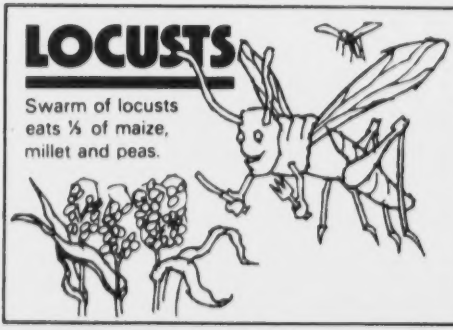
NORMAL HARVEST

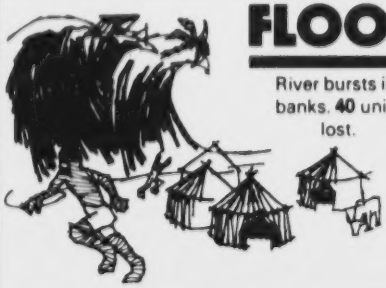
– but yams are attacked by a pest. ⅓ of the yam crop lost.



LOCUSTS

Swarm of locusts eats ⅓ of maize, millet and peas.





FLOOD

River bursts its banks. **40** units lost.

LOCALISED DROUGHT

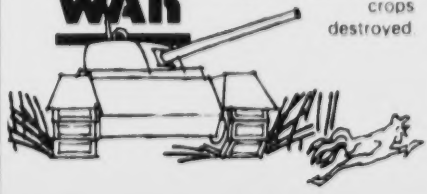
The Harvest is **40** units less than expected. (**70** if this is the second consecutive year of drought.)

SEVERE DROUGHT

The Harvest is **80** units less than expected. (**120** if this is the second consecutive year of drought.)

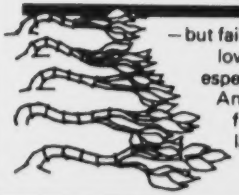
CIVIL WAR

Rebel and Government troops fighting near your village. **200** units of your crops destroyed.



SET 3
HELP CARDS

NORMAL HARVEST

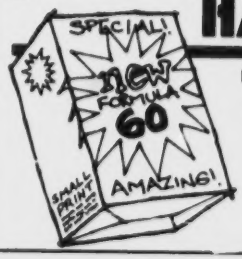


– but failure to rotate crops can lower your yield. Cassava especially exhausts the soil. Anyone who has grown 4 fields of cassava for the last 2 years gets **60** less food units.

Plenty of greenery around for cattle feed, and for manure. More than the usual amount of meat available – and good crops from manured land. Add **30** food units (or **50**, if this is the second consecutive normal harvest).

NORMAL HARVEST

NORMAL HARVEST

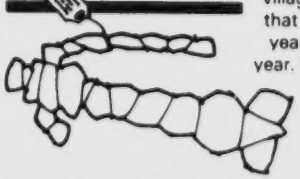


New variety of millet available that produces **60** units in a wet year – but only **20** in a dry year. Anyone can use the seed next year.

NORMAL HARVEST

– but storage of food is a major problem. Rats and other pests eat **40** units.

NORMAL HARVEST



A Charity in Europe offers one village a well and pump. This means that one village has 4 fields that can give 'wet year' yields every year. Which village is to have it?

NORMAL HARVEST

– but cassava is attacked by 'mosaic' disease, a little worm that eats into the root, and up the stem. ⅓ the cassava crop lost.

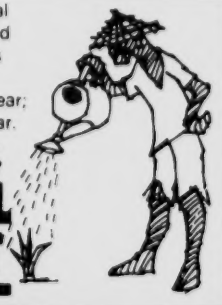
NORMAL HARVEST

– but maize is affected by 'rust', a disease of the leaves. It produces only **40** (wet year) **20** (dry year) food units.

The Food and Agricultural Organisation of the United Nations tries out 10 fields with new maize seed.

It yields **120** in a wet year; but only **10** in a dry year. Which villages will join in the experiment next year?

NORMAL HARVEST



BEST COPY AVAILABLE

NO HELP
Your problems are not dramatic enough, and the newspapers and T.V. in Europe are not interested. No one knows about you. Agencies cannot raise any money for you.

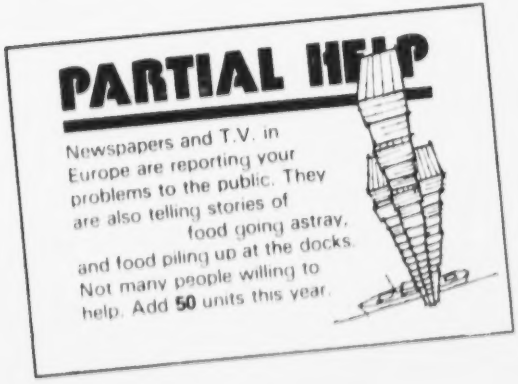

PARTIAL HELP
Newspapers and T.V. in Europe are reporting your problems to the public. They are also telling stories of food going astray, and food piling up at the docks. Not many people willing to help. Add 50 units this year.

Figure III Analysis of Examples in Part II

GAME TITLES	CONTENT COVERAGE (Unesco subject areas)				
	NATURAL RESOURCES	POLLUTION	URBAN DEVELOPMENT	HEALTH & NUTRITION	NATURAL DISASTER
SPRING GREEN MOTORWAY		○	◎		
HOUSES GAME			●		
POVERTY	○			◎	○
CARIBBEAN FISHERMAN	◎			○	○

○ Low content ◎ Medium content ● High content

IV Caribbean Fisherman

Designed by Rex Walford, University of Cambridge (permission to reproduce gratefully acknowledget to the Longman Group Ltd. — the copyright owner — who publish and operate a subscription scheme for a series of geography game through their Resource Unit, 33–35 Tanner Row, York, Yorkshire YOI IJP)

Aims

The game illustrates some of the typical problems man comes across when he tries to exploit his environment. In this case, Caribbean fishermen have to cope with the unpredictability of current and weather in trying to maximize their catch. The game provides vivid examples of the hazardous nature of fishing as an employment activity.

Context

Although one of a set of geography games, it is highly adaptable and has been used in many related subject areas. The designer's development ideas and explanatory material which follows suggest a number of guidelines for instant use and initial elaboration. At this stage it should be noted that the simple introductory game can be played by individuals, pairs or groups. Usually between 1 to 2 hours is required and children over 12-years have used the material without difficulty.

Equipment

It is a simple pencil and paper game and all the introductory material, proformas and operating instructions are provided on the following pages.

Operating procedures

1. Introduction

You are a fisherman, living with your family on a small Caribbean island. The rare visitors, other than government officials, come in chartered yachts which they anchor in the good holding ground inside the reef. These visitors swim over the reef all day long and sometimes come ashore to buy fruit or basketwork made by the women. When you talk to them they usually say that they envy the easy simplicity of your life, though one did suggest that you 'aim to increase production fishwise by working at weekends'. Not a very sensible idea because there is cricket on Saturday and Sunday is set aside for church and parties — a man can't change a way of life.

That boat drawn up on the beach and the gear piled up at the side of your house cost a lot of money, a lot of work and a lot of doing without. Fishing is a risky job. There are currents which sweep away pots and storms which can take boat, gear and even a man's life. It's a big responsibility and sometimes you just have to take a chance so that you can earn the *80 Bonita dollars (BD) a week EXPECTED INCOME needed to support your family.*

2. Fishing practice

Each evening you go out from Puerto Bonita in your small boat to put out your pots to catch shellfish. The following morning you lift the pots to see what you have caught and then take your catch back to Puerto Bonita in order to sell it to the traders in the market.

Smaller fish are found *inshore* (east of the small reef island). It is always safe to fish inshore, but the fish are of less value to the market traders. The bigger shellfish are found *offshore* (west of the reef island) and these fetch a higher price. However, a strong and unpredictable current runs on the offshore area and sometimes pots are swept away and lost.

On a fine day inshore pots usually produce fish worth 2 BD, while under the same conditions pots fished offshore usually raise 6 BD.

3. The strong current

When the offshore current runs it inevitably sweeps away pots laid west of the reef island and they have to be replaced. On such days the offshore pots bring home no profit. On these bad days the only fish is from the inshore pots and, because of the scarcity, the value of the catch rises to 4 BD per pot.

We can put this in a table:

WEATHER	VALUE OF CATCH FROM EACH INSHORE POT (BD)	VALUE OF CATCH FROM EACH OFFSHORE POT (BD)
GOOD DAY	2	6
BAD DAY	4	0

NB: After a BAD DAY you lose all pots placed offshore and will have to pay the pot maker 5 BD for each pot you wish to replace.

The unpredictable current is obviously a big hazard to your fishing. Experience has shown that the current runs about 1 day in 5. However, it is also clear that once the current is running there tends to be a sequence of bad days rather than an isolated one. There is no certainty about this, but the observation is passed down in a calypso.

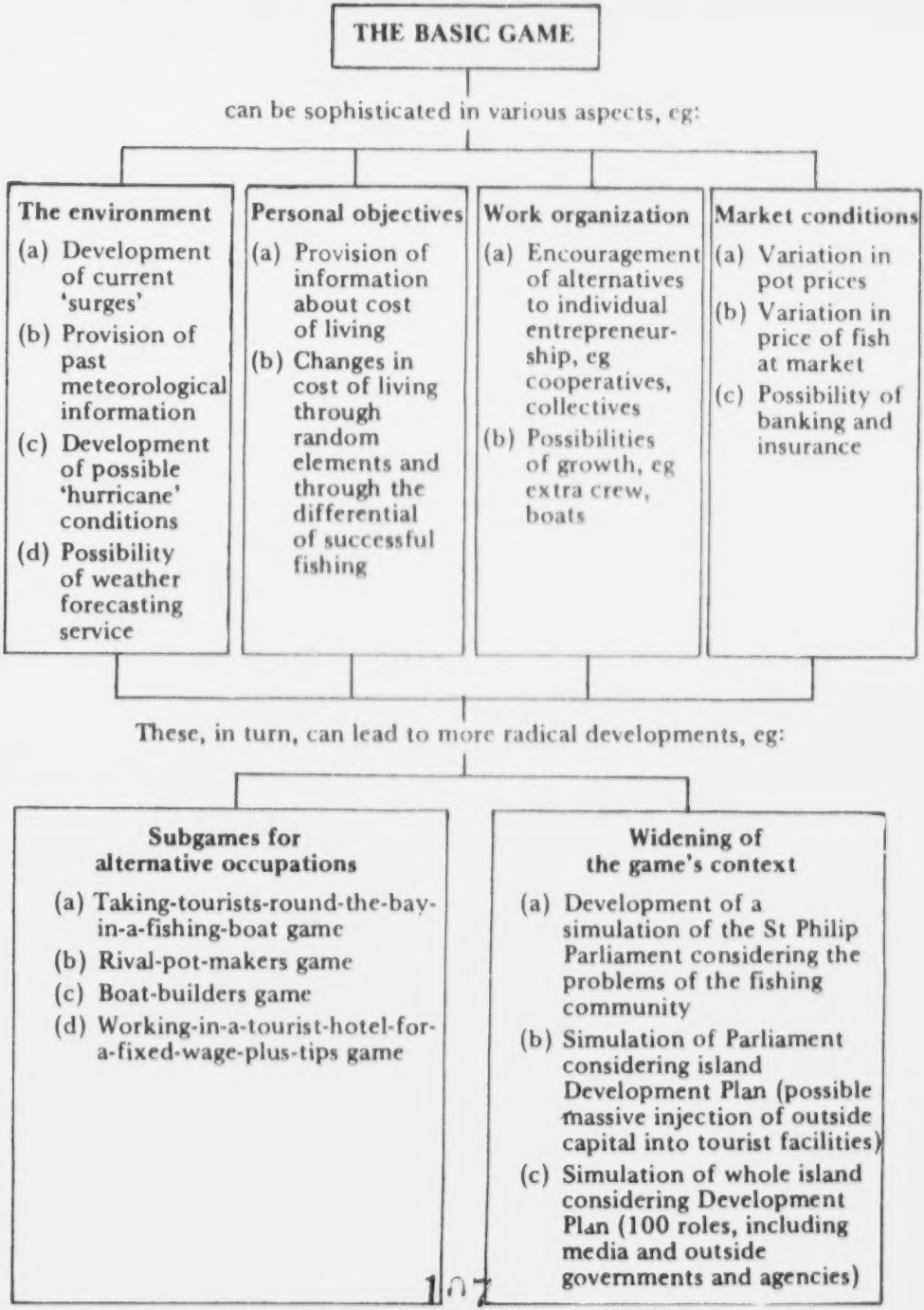
Ocean King he has five daughter.
Which he call to fetch the water?
If she spill it she must pay.
By fetch the water nother day.

Very very rarely — when there is a freak storm — you might even lose your boat altogether. That would cost you 100 BD to replace.

Now you have enough information to start fishing.

4. How to Play

1. Look at the Record sheet on page 111 and note the heading of each column. You will complete these columns after each round. 1 round = 1 day.
2. Make the first decision about where to fish with your six pots. You can put them inshore and offshore in any combination; for example, 3 and 3, 4 and 2, 5 and 1, 6 etc.
3. Throw the dice to simulate the weather or wait for this to be done by the teacher. You will then find out whether you have had a good or a bad day and this will affect the value of your catch.


THE BASIC GAME
can be sophisticated in various aspects, eg:
The environment
(a) Development of current 'surges'
(b) Provision of past meteorological information
(c) Development of possible 'hurricane' conditions
(d) Possibility of weather forecasting service
Personal objectives
(a) Provision of information about cost of living
(b) Changes in cost of living through random elements and through the differential of successful fishing
Work organization
(a) Encouragement of alternatives to individual entrepreneurship, eg cooperatives, collectives
(b) Possibilities of growth, eg extra crew, boats
Market conditions
(a) Variation in pot prices
(b) Variation in price of fish at market
(c) Possibility of banking and insurance
These, in turn, can lead to more radical developments, eg:
Subgames for alternative occupations
(a) Taking-tourists-round-the-bay-in-a-fishing-boat game
(b) Rival-pot-makers game
(c) Boat-builders game
(d) Working-in-a-tourist-hotel-for-a-fixed-wage-plus-tips game
Widening of the game's context
(a) Development of a simulation of the St Philip Parliament considering the problems of the fishing community
(b) Simulation of Parliament considering island Development Plan (possible massive injection of outside capital into tourist facilities)
(c) Simulation of whole island considering Development Plan (100 roles, including media and outside governments and agencies)

A model of the variations in the game idea

1 DAY OF THE WEEK	2 POTS PLACED INSHORE Worth 2 on good days Worth 4 on bad days	3 POTS PLACED OFFSHORE Worth 6 on good days Worth 0 on bad days	4 WEATHER Good or bad	5 DAILY REVENUE	6 COST OF ANY REPLACEMENT POTS (5 BD per pot)	7 DAY'S PROFIT (OR LOSS)	8 TOTAL PROFIT (OR LOSS)

III

Record sheet

4. Look at the table on page 111 and work out how much money you made from your day's fishing. Enter the result in Column 5 on your Record sheet.
5. If it was a bad day and you lost pots offshore, decide if you want to replace them to go out fishing again with six pots the next day. (It is usually a good idea to do so.) Fill up Column 6 with the cost of these replacement pots.
6. Work out Column 7. This is your day's profit, i.e. the amount of revenue that you gained from selling your fish minus the cost of any pots you have had to replace.
7. Work out Column 8 — your total profit and loss to date.
8. Repeat steps 3–8 for another four days.

At the end of a week's fishing see if you reached the expected income level of 80 Bonita Dollars.

Then go on and play a second and third week and see if by experience and better strategy you improve as a fisherman.

Once you have got the idea of the game you may want to introduce extra rules to bring the game closer to reality (see diagram).

For instance:

a. Would the cost of pots always be 5 BD? If some people play pot makers there may be a variable price for the cost of pots. Perhaps the pot makers might offer 'pot bargains' from time to time — say 10 pots for 45 BD at the start of the week.

b. If you got together with some other fishermen might you not earn enough amongst you to finance the purchase of another boat plus six pots (130 BD)? Once you had an extra boat fishing for you perhaps you would make more money.

c. What happens if you have a loss rather than a profit? Perhaps someone can play the bank manager or moneylender, and you can see the difficulties of borrowing money and having to pay to borrow it.

V. Can you design your own simulation? A game frame for generating games

Aims

The game frame presented in this section is intended to provide concrete guidance to curriculum developers and teachers on how to design original games related to particular conditions. It constitutes a practical synthesis of the methodological guidelines, procedures and examples previously developed.

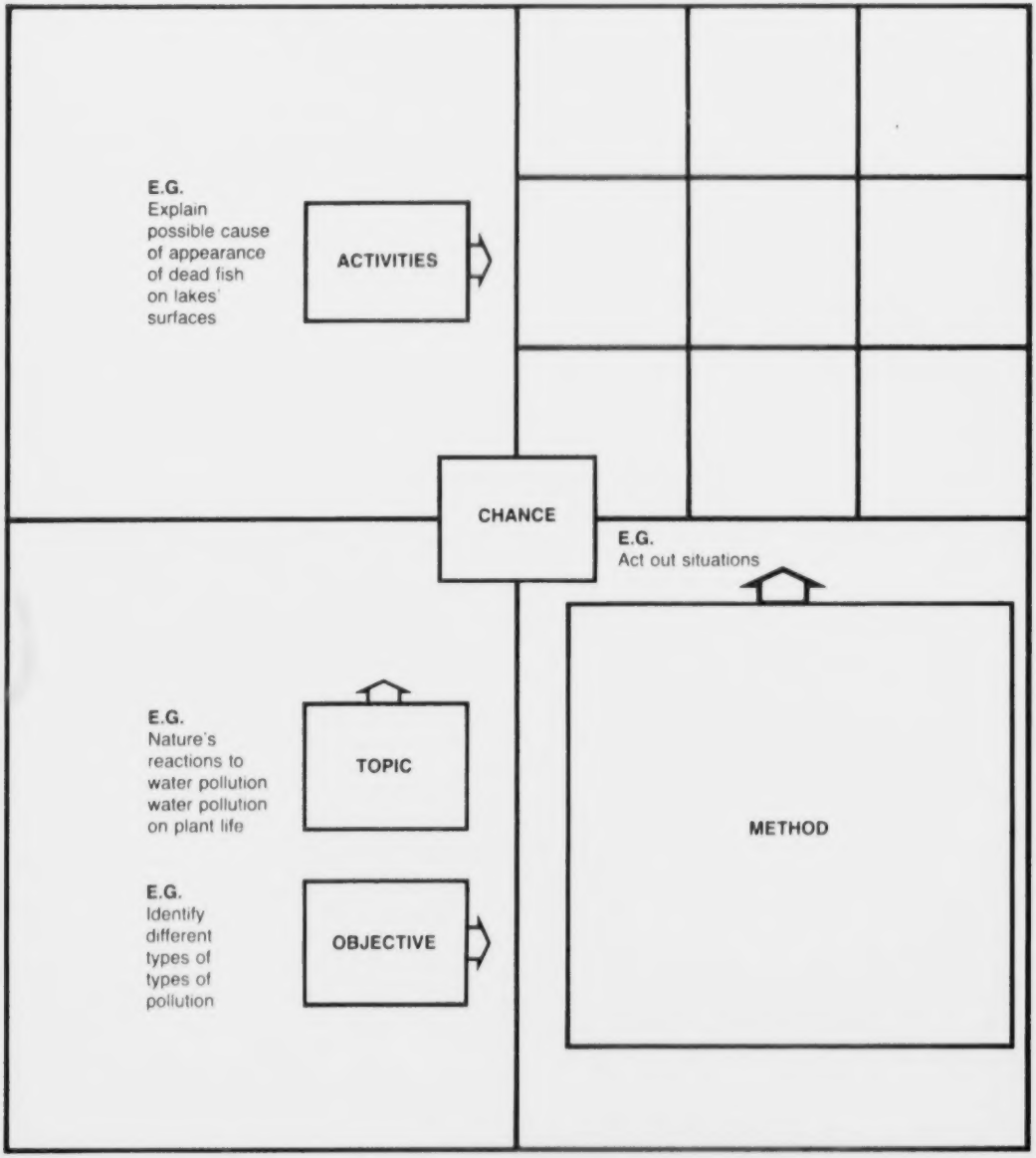
Context

The game frame has been developed as an extension of a game designed by Henry Sanoff in 1979. After presenting the Sanoff game, which is useful in itself for environmental education planning purposes, its methodological approach has been applied to a *game helping to design games*. Given the relative complexity of the concepts and methodological procedures used in this game, it is addressed particularly to curriculum developers, educational researchers and teachers.

SANOFF'S GAME TO HELP GENERATE IDEAS FOR ENVIRONMENTAL [EDUCATION] PROJECTS

(from *Design Games* by Henry Sanoff, 1979, William Kaufmann Inc., One First St., Los Altos, CA. 94 022)

Adaptation of Sanoff's Framework



Adapting Sanoff's framework

Sanoff's game designed to generate ideas for environmental projects is a dynamic framework which can be used as a point of departure for a number of activities. To illustrate the flexibility of the framework it is possible to take the basic idea and to follow the steps already identified in Chapter IV, so as to produce a fully fledged purpose-designed game, e.g. if we take the case of pollution identified in lakes within a country estate with adjacent farming and mining activities it is possible to have a sequence set out on the following lines:

1. Defining the problem
Pollution is killing life in lakes

2. Intent of game
a) To discover the impact of pollution in a case study situation.
b) To learn methods of pollution control.
c) To discover the best ways of balancing the natural system in a lake, while avoiding and abating pollution.

3. Setting the scenario
260 acres of landscaped parkland contain 50 acres of well-stocked lakes. A farmer owns arable land 400 yards beyond the southern boundary of the lakes.

4. Defining roles

Parkland landowner
The pollution has affected the demand for fishing and sailing licences, and the public enjoyment of visiting the lakes, due to the smell of rottingfish.

Industrialist
The owner of a mine upstream from the lakes has been discharging waste and polluants into the lakes. Recently he has had to make several hundred miners redundant, and the union is threatening a strike.

Adjacent farmer
The arable land is his only means of livelihood since he lost all his livestock in a foot-and-mouth epidemic. Pesticides he uses on crops are washed into the lake whenever it rains.

Regional Commissioner of Water Pollution
He is employed to control pollution by routine inspections and suggest abatement measures, but he failed to make the last routine inspection. He is empowered to impose fines.

5. Specifying game rules

(a) *Select* an Objective from list A (see page 121)
Discuss Choice
Decide on the group choice
Place the card on the slot.

(b) *Select* a Topic from list B (see page 121)
Discuss Choice
Decide on the group choice
Place the card on the slot.

(c) *Select* an Activity from list C (see page 121)
Discuss Choice
Decide on the group choice
Place the card on the slot.

(d) *Select* a Learning Method from list D (see page 122)
Discuss Choice
Decide on the group choice
Place the card on the slot.

(e) *Select* a Chance Card from list E (see page 122)
Discuss Choice
Place the card on the slot.

6. Drawing up an accounting system

Using the standard worksheet as illustrated on page 117 Specify:

(a) *Learning objectives*
A statement of the characteristics to be achieved.

(b) *Activities designed to:*
(i) Accomplish the objectives, and;
(ii) Achieve the conditions necessary to perform the task.

(c) *Methods of presentation*
The methods used to record and present objectives, methods and activities.

(d) *Evaluation criteria*
The method of evaluating the work.

7. Building a prototype

Using Sanoff's game as an example, it is possible to devise a similar framework along the lines of diagram 1 page 127.

8. Running developmental trials

Using all the elements so far described it should be possible to proceed through a simple sequence of activities which might form the basis of a fundamental learning cycle.

9. Finalizing the documentation and equipment

If the operational cycle is basically sound, then fine tuning can result in the finalization of all the documentation and related equipment. However, it should be stressed that the case just presented is a simplistic overview of a very elementary type and will need elaboration according to different circumstances.

Examples lists

A. Objectives example list

1. Identify different types of pollution.
2. Understand the consequences of different types of pollution.
3. Understand how overpopulation of species is a form of pollution.
4. Understand the relationships between the role players.
5. Understand the importance of financing in the control of pollution.
6. Understand the balance-of-nature concept and long-term versus shortterm gains.

B. Topics example list

1. Nature's reactions to water pollution on plant life.
2. How industrial plants and urban sewage works use treatment processes.

C. Activities example list

1. Explain possible cause of the appearance of dead fish on the lakes' surfaces.
2. Explore the sources of visual pollution when an oil slick and sludge appear on the lake surface.

D. Learning methods example list

1. Act out situations.
2. Identify and talk to experts.
3. Display, manipulate and adjust interrelationships between factors.
4. Play roles and change roles.
5. Describe environmental settings.
6. Chart possible evolutions of dynamic situations over a period of time.
7. Generate hypotheses and test them.
8. Analyse evidence and strategies.
9. Question people's attitudes.
10. Evaluate decisions and feedback of positive and negative reinforcement.
11. Select and organize data.
12. Synthesize the environmental data and the vagaries of chance.

E. Chance card example list

1. The sluice gate has broken and will require major repairs.
2. Recent hot weather has de-oxygenated the lakes.
3. The lakes have been over-populated with carp.
4. Evidence of steel works discharging hot water into the lakes.
5. Pesticides have killed fish.
6. A storm causes D.D.T. on the farmer's land to run into the lakes.
7. A fine is imposed for causing pollution.

How to start designing original simulations

After reading this handbook and working through the preceding examples, the reader should be encouraged to run and design his own simulations. For example, it is possible to extend the basic Spring Green Motorway model by relating other issues to your own community concerns and reactions.

Stage One
Start by getting the class to bring along copies of the last month's local newspapers. Get each class member to cut out 5 new items likely to have an impact on the quality of the environment in their area.

Each item should be displayed on the classroom walls and students should be asked to vote on which 5 topics represent their majority concerns.

Stage Two
Divide the class into four equal groups who are asked to play one of four roles i.e.:

(a) Conservationists
These community members wish to preserve their environement as it stands. They are against change and do not wish to see any alteration in the quality of life currently enjoyed by members of like mind; or

(b) Employers
Members of this group are concerned with the development of a thriving community. Although they give a high priority to economic expansion and growth they are not oblivious of the fact that environmental quality can be instrumental in achieving and maintaining a viable market for products as well as helping to build up a community; or

(c) Workforce
The workers naturally wish to preserve and enhance their job satisfaction and employment prospects. They are worried by any redundancy threats and value the provision of good educational services as a potential ladder to improved job opportunities; or

(d) The Uncommitted
This group represents the sector of the community usually referred to as floating vote — that is to say they are people whose views, allegiances and

votes fluctuate according to changing conditions. They can ask awkward questions and can be swayed by good argument.

Each group as an entity is asked to establish its independently stance in relation to each of the five issues already recognized as priority topics of concern.

Stage Three

Bring the class together to simulate a town meeting. First let them vote on their preference order for considering the 5 agenda items already selected. A meeting chairman and clerk must be elected and each item on the agenda can then be discussed according to the order previously established. The clerk can monitor the impact of the discussion on a *standard assessment form* of the type shown below (see page 130) and can summarize the debate before a meeting vote is taken.

De-briefing

Once such a simple priming game is discussed in a de-briefing session pupils can go on to:

(a) *focus* on particular types of issues more relevant to different environmental considerations,
(b) *identify* various town council member profiles related to their own governmental area and party manifestos and objectives,
(c) *specify* leading community lobby groups and evaluate their power and prestige,
(d) *consider* how different council professional officers might supply technica advice to influence discussion and improve the monitoring of public opinion and impact analysis.

The newspaper cuttings which follow (see pages 127 to 129) represent some of the types of issue likely to provoke discussion — every newspaper is rich in such stories and they represent a readily accessible set of local perspectives and concerns. Your task now is to run a simulation exercise which will focus on the central aspects of local environmental concerns. The basic framework just outlined can be elaborated to fit specific needs and appropriate roles as time allows.

The class have the chance to isolate their own issues and to select the roles and role profiles they perceive to be important. The impact monitoring sheet admits much further elaboration and the work of Duke (1974), Helmer and Gordan (1966) as well as Armstrong and Hobson (1973) may provide useful pointers here.

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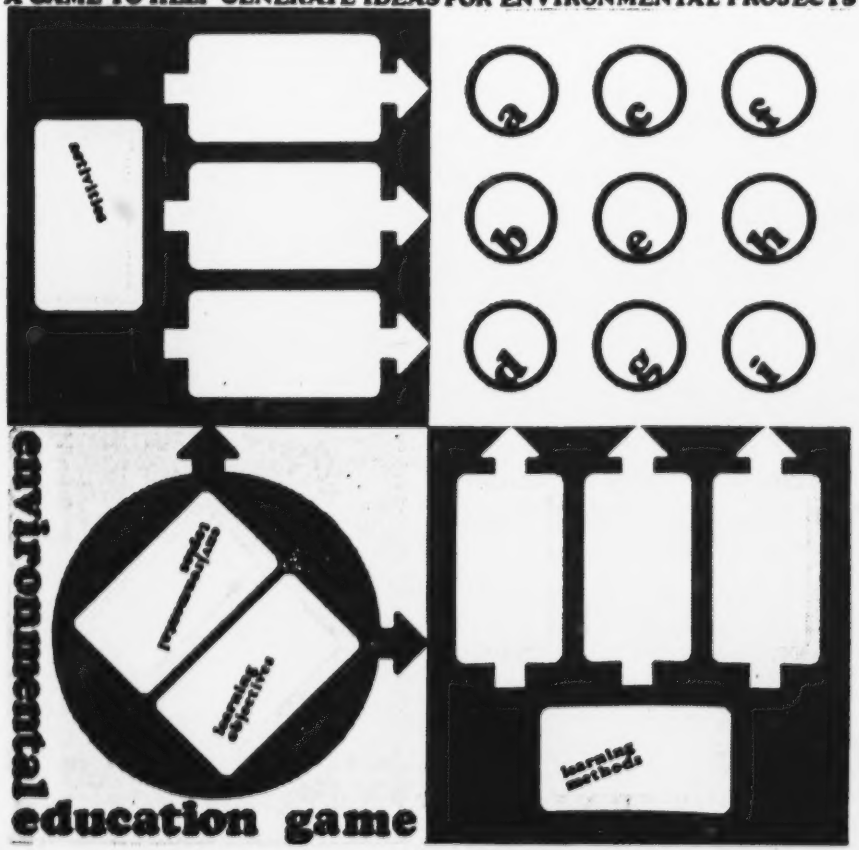
V. CAN YOU DESIGN YOUR OWN SIMULATION? - A GAME FRAME FOR GENERATING GAMES

Aims — The 'game frame' presented in this section is intended to provide concrete guidance to curriculum developers and teachers on how to design original games related to particular conditions. It constitutes a practical synthesis of the methodological guidelines, procedures and examples previously developed.

Context — The 'game frame' has been developed as an extension of a game designed by Henry SANOFF in 1979. After presenting the SANOFF game, which is useful in itself for environmental education planning purposes, its methodological approach has been applied to a game helping to design games. Given the relative complexity of the concepts and methodological procedures used in this game, it is addressed particularly to curriculum developers, educations researchers and teachers.